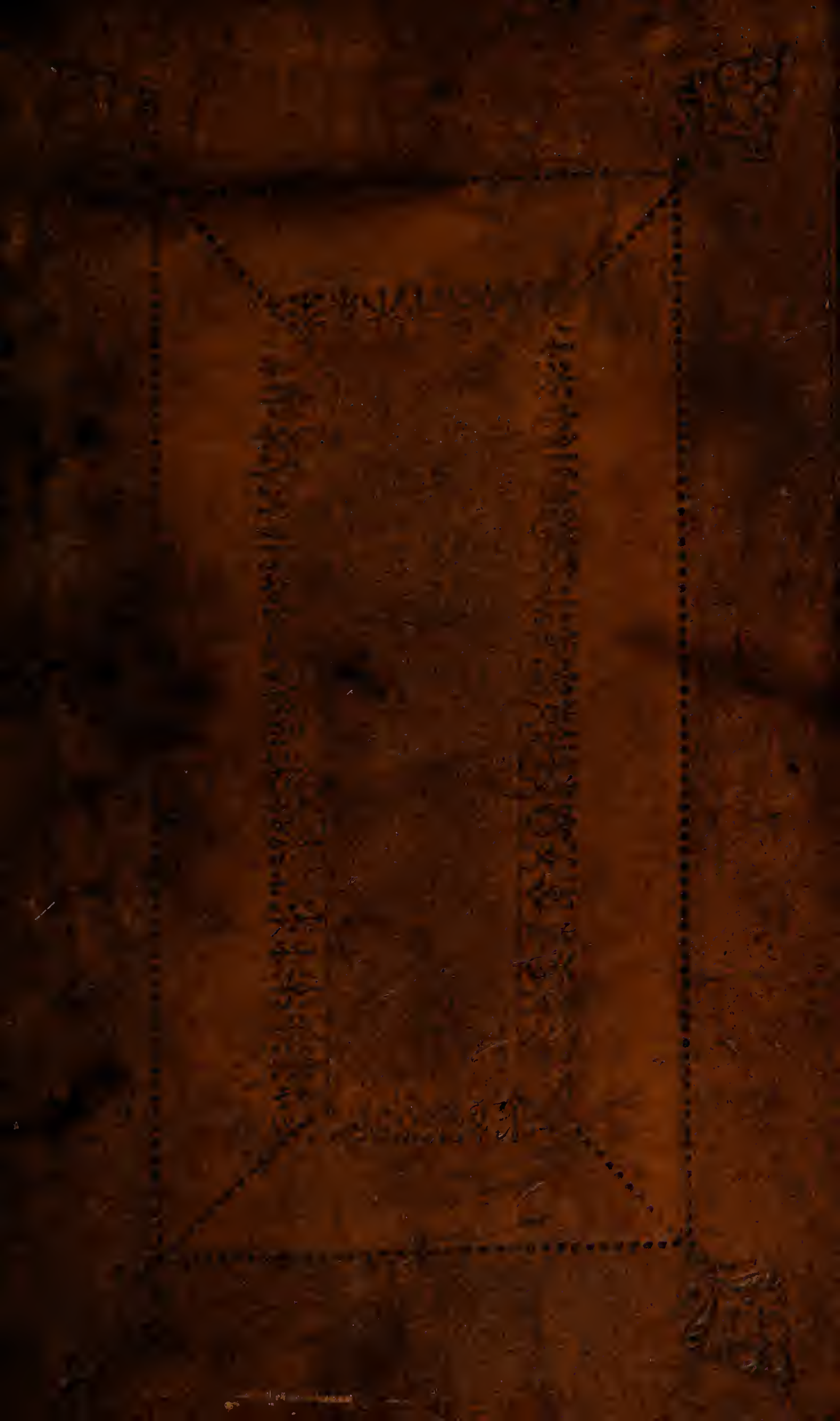

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MEMOIRS
OF THE
ROYAL ACADEMY
OF
SCIENCES in *PARIS*
EPITOMIZED.

WITH THE

LIVES of the late MEMBERS
of that SOCIETY.

AND A

PREFACE by Monſieur *FONTENELLE*,
Secretary and Author of the HISTORY of
the ſaid ACADEMY.

The SECOND EDITION.

LONDON:
Printed for WILLIAM and JOHN INNYS, at the
Weſt End of St. *Paul's*. M. DCC. XXI.

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TO THE
Right Honourable
The Lord *PARKER*,
Lord Chief-Juſtice of *ENGLAND*,
&c. &c.

MY LORD,

I Can make no other Apology for Inſcribing theſe Papers to You, without your conſent or knowledge, but that if I had had the Happineſs of being acquainted with a *Wiſer*, *Better*, or more *Learned*

Man than your Self, You ſhould not have been troubled with them: This being premiſed, allow me, my Lord, to give You a ſhort Account of my Project. Among all kinds of Hiſtory, I have been a great Admirer of that which goes by the Name of *Biography*, or an Account of the *Lives of Great and Good Men*, becauſe of the Uſefulneſs of it, both to the preſent Age and to Poſterity: Every body knows how much more weight Examples have than Precepts; and I need not tell any body here in *England*, that the Behaviour of a Lord *Parker* has made more *Mathematicians*, *Philoſophers*, and *Divines* too, among the *Gentlemen of the Long Robe*, than even Sermons, or the Lectures of our moſt Learned

Profeſſors. Theſe Thoughts put me formerly upon making a Collection of the Lives of ſome of the moſt famous Men of our own Nation for any particular Art or Science, but the Project was too big for me, and ſo I let it drop: Since then I happen'd to fall upon the *Hiſtory* of the *Royal Academy* of *Sciences* in *French*, publiſhed by the Learned and Ingenious Monſieur *Fontenelle*, Author of the *Hiſtory* of *Oracles*, *Plurality* of the *Worlds*, *Dialogues* of the *Dead*, &c. which your Lordſhip has ſeen and read, and which I am ſure You could neither ſee nor read, without admiring. This Monſieur *Fontenelle*, my Lord, ſucceeded Monſieur *Duhamel* in the Office of Secretary to the above-mention'd Academy, as he tells us himſelf in the Life of that great Philoſopher, and has publiſh'd all the Tranſactions of that learned Body of Men by way of Annals, beginning with the Year 1699, (which was the *Era* of their Re-eſtabliſhment) and ending with the Year 1712. His Stile is inimitable, and therefore I don't doubt but I have wrong'd him by my Poor and Literal Verſion; but the Pleaſure I ſhall give, for all that, to ſuch of my Inquiſitive Countrymen, that don't underſtand *French*, will perhaps attone for my Preſumption.

My Lord, Among other curious Matters compriz'd in the ſaid Hiſtory, as often as any Member died it was the Buſineſs of the Secretary to make his *Elogy*, as Monſ. *Fon-*

tenelle calls it, that is to ſay, a *Funeral Oration*, in which he gives an Account of the moſt remarkable Paſſages of the Life of their late Member, eſpecially with reſpect to the Books and Papers publiſh'd or left in MS. behind him. This had ſo near a Relation to my beloved Project of Publiſhing the *Lives* of *Great Men*, that I immediately ſet my ſelf about Tranſlating thoſe *Elogies*; and in a few Months, during my Receſs in the Country the laſt Summer, I finiſh'd not only the Account of all thoſe *French* Philoſophers that have died ſince the laſt Eſtabliſhment, but, upon the Requeſt of my Bookſeller, who himſelf is a Retainer to Philoſophy, being employ'd in Printing the Tranſactions of that Illuſtrious Society (of which your Lordſhip is one of the Greateſt, and I the meaneſt Member) I have proceeded to Tranſlate ſome of the moſt curious Relations of Philoſophical Matters; in doing which I have affected to join the *Utile* with the *Dulce*, according to the Poet's Advice; and where I could, to give the Extract of ſuch Pieces as proceeded from ſome of thoſe Ingenious Men, whoſe Lives have been accounted for before. I intended to have cloſed the Whole, my Lord, with what Monſ. *Fontenelle* calls *Various Obſervations upon Phyſicks in General*, which contains the *Hiſtory of Surprizing Phenomenons in Natural Philoſophy*, that from Year to Year have been communicated to the Academy from all Parts of the World, and which, by reaſon of the Variety of the Subjects, could not be ranged under peculiar Heads; but finding the Work already grown too big under my Hands, I ſhall reſerve this laſt Part for another Opportunity.

In ſhort, my Lord, the whole Book is an Abſtract of ſome of the Choiceſt Pieces, Memoirs, Diſſertations, *&c.* that have been brought or ſent from time to time to the *Academy of Sciences*, moſtly by their own Members, within the compaſs of Thirteen or Fourteen Years, and diſpers'd through almoſt twenty Volumes, in which there is ſtill ſo good Gleaning, that if what I have now Publiſh'd be agreeable to your Lordſhip, and in any manner uſeful to my Country, and it ſhall pleaſe God to continue me the Health and Leiſure I now enjoy, your Lordſhip's Commands ſhall always direct the Uſe of both, whenever You ſignifie the ſame to,

Weſtminſter 25.
March 1717.

My Lord,

Your Lordſhip's moſt Faithful

Humble and Obliged Servant,

John Chamberlayne.

POSTSCRIPT.

My LORD, I think my ſelf bound to mention, by way of Poſtſcript, a kind of a Negative Injuſtice and Affront which the Ingenious Hiſtorian of the Tranſactions of the *Academy* has put upon our Nation, and more immediately upon the *Royal Society*. Your Lordſhip will obſerve in the Lives of the Marquis *de L'Hopital*, and Meſſieurs *Viviáni*, *Guglielmini*, and *Bernoulli*, Four of the greateſt *Mathematicians* of *Europe*, and all Members of the ſaid *Academy*, that there is an Account given of the *Differential Calculation*, and the Invention thereof, which I think is every where aſcribed to the late Monſ. *Leibnitz*, a Privy-Counſellor and Hiſtoriographer of his Majeſty, as Elector of *Brunſwick-Lunenberg*, and one of the moſt Learned Men of our Age; at leaſt it is no where attributed, as it ought, to our own Countryman Sir *Iſaac Newton*, the Firſt Mathematician in the World. Now it is notorious that the Writers of the *Acta Leipſienſia* make Monſ. *Leibnitz* the Author of the ſaid Differential Calculation; but it is not leſs known to your Lordſhip, that Dr. *Keill*, in the *Commercium Epiſtolicum*, has done our *Britiſh Philoſopher* juſtice; and has fully proved that which Mr. *L.* did in ſome manner acknowledge to me (when I attempted to reconcile theſe two Great Men) that Sir *I. N.* might be the firſt Inventer, but that he himſelf had luckily fallen about the ſame Time upon the ſame Notions.

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THE PREFACE.

THE Account of the *French Academy of Sciences* conſiſts of two Parts; the firſt which we call more particularly the *Hiſtorical* Part, is an Extract and Abridgment of all the remarkable Things that have been reported to that Society, either by Writing or Word of Mouth. The ſecond are the *Memoirs*, that is to ſay, ſome of thoſe Pieces read in the *Academy*, and eſteem'd the moſt important, and moſt worthy to be communicated to the Publick at their whole Length.

The *Memoirs* are in a manner what we call in a common Hiſtory, the Authentick Acts, or Documents, and are publiſhed with the ſame, by way of Appendix.

This *Hiſtorical* Part comprehends more than the *Memoirs*, being a Collection of ſuch Matters as were not thought proper to be deduced at length, and yet ought by no Means to be entirely omitted;

and whether it treated of Subjects that were common to the *Memoirs*, or diſtinct from them, it was thought moſt proper to bring it down to the reach of all ſuch as have but a moderate Tincture of the Mathematicks, or of Natural Philoſophy: We have therefore endeavoured to render this Hiſtory, as near as we could, intelligible to all Sorts of Perſons, and have taken care to interpoſe occaſionally, ſuch Explanations as may facilitate the reading the *Memoirs*, ſome of which might perhaps be more clearly underſtood, if they were joyned to that Part of the Hiſtory that tallies with them.

When we met with a Subject that would not bear turning another way, nor to be treated of more ſuperficially than it was in the *Memoirs*, which happens ſometimes in the Caſe of Machines, or in Demonſtrations, Geometry and Algebra; we have been forced to paſs them over in ſilence, unleſs there was occaſion of giving ſome Hiſtorical Account of the Progreſs that had been made therein, or to relate the News to thoſe who would at leaſt be very glad to hear of the Advancement made of any particular Art or Science.

And on the contrary, when a Matter contained in the *Memoirs* was ſo intelligible, that it could not be render'd more plain by the Hiſtory, we have ſpared the unneceſſary Pains of repeating it.

In general, we have been of Opinion, that for the ſake of thoſe that were but ſuperficially, as well as of thoſe that were profoundly Learned, it would not be amiſs to preſent under two different Forms, the Matters which compoſe this Collection, by which Means the Labours of the *Academy* would be better known, and the Taſt and Reliſh of Sciences would be more enlarged.

But to what purpoſe is it to extend the Love of Mathematicks, and of Philoſophy, and of what Uſe are theſe Labours of the *Academy?* This is a very common Queſtion, and which indeed the moſt part of the World will hardly allow to be ſo much as a Queſtion.

We readily look upon that which we don't underſtand as uſeleſs and unprofitable; 'tis a kind of Revenge we take upon Learning; and foraſmuch as Philoſophy and Mathematicks are generally but little known, they do as generally paſs for uſeleſs Things. The Source of this Unhappineſs is plain, they are *Wild* and *Thorny*, and very hard to come at.

We have one Moon to light us during the Night; What is it to us (ſay they) if *Jupiter* has four? What occaſion is there for ſo many painful Obſervations, ſo many tedious Calculations to diſcover exactly the Courſe of them? They will not yield us the more Light for it; and Nature, which has placed theſe little Stars out of the reach of our Eyes, does not ſeem to have made them for us. In Conſequence of ſuch plauſible Reaſonings is, that we ought not to have obſerved them with the Teleſcope; and if we had not, it is certain that we had been great Loſers; for thoſe that underſtand never ſo little the Principles of Geography and of Navigation, know, that ſince the Diſcovery of *Jupiter*'s Moons, they have been more uſeful to us, with reſpect to thoſe Sciences, than even our own Moon; and that they ſerve, and will always ſerve more and more to make our Sea-Charts incomparably more exact than the ancient ones, and thereby will probably ſave the Lives of an infinite number of Sailors. If in the whole Science of Aſtronomy there were no other Advantage than that which is produced by the Diſcovery of *Jupiter*'s Moons, it would ſufficiently juſtifie thoſe vaſt Calculations, thoſe conſtant and nice Obſervations, that great Apparatus of Inſtruments wrought with ſo much Care, and that noble Edifice, erected ſolely for the Uſe of this Science. In the mean time the Maſs of Mankind either knows nothing of theſe Satellites or Moons of *Jupiter*, unleſs it be by hear-ſay, and very confuſedly, or are entirely ignorant of the Connexion it has with the Art of Navigation; or do not ſo much as know that that Art is become more perfect in the preſent Age.

Such is the Fate of thoſe Sciences, that are in the hands of a ſmall Number of Perſons; the Advantage of their Progreſs is inviſible to the greateſt part of the World, eſpecially if they are ſhut up in ſuch Profeſſions as do not make a great Noiſe. Why are we arrived at a greater Facility in this Age to carry on Rivers, make Canals, and eſtabliſh new Navigations? Why, it is becauſe we underſtand much better the Art of *Levelling* a Country, and of making *Sluices*.

Builders and Mariners have been eaſed in their Labours, without ſo much as diſcovering the Skill of the *Geometrician* that help'd them; they have been moved in a manner, as the Body is by the Soul, without ſo much as knowing it; the reſt of the World are yet leſs able to diſcover the Genius which preſides over any Enterprize; and it is with a kind a kind of an Ungratitude that the Publick enjoys the Succeſs thereof.

The Science of Anatomy, which of late has been ſo carefully ſtudied, could not become more exact without rendring the Art of Surgery more ſafe in its Operations. This the Surgeons know very well; but thoſe that reap the Benefit of their Art, know nothing of the matter; And how ſhould they? They muſt compare the Ancient Surgery with the Modern; that would be a great Study, and by no means agreeable to them. The Operation has ſucceeded, and that is enough; What need is there of knowing whether in another Age the Succeſs would have been equal?

'Tis amazing to conſider how many things ſtand before our Eyes without our perceiving them: The Shops of Artificers ſhine on all ſides with Ingenuity and Invention, which nevertheleſs do not attract our Obſervations; Spectators are wanting to the moſt uſeful Inſtruments and moſt ingenious Works, and nothing would be more *Marvellous*, to ſuch as knew how to be affected therewith.

If a Society of Learned Men have, by their noble Endeavours, brought to a greater Perfection *Geometry*, *Anatomy*, the *Mechanicks*, or any other uſeful Science, we muſt not pretend to ſeek out this remote Spring to make known our Obligations to them, and to do Honour to the Uſefulneſs of their Diſcoveries. It will always be more eaſie to the Publick to enjoy the Advantages that ariſe from thence, than to attain to the Knowledge thereof. The Determination of the *Longitudes* by *Jupiter*'s *Moons*, the Diſcovery of the *Ductus Thoracicus*, a more convenient and exact Method of *Levelling*

Levelling are not ſuch kind of Novelties as will make a noiſe like a fine *Poem*, or an eloquent *Harangue*.

The Advantage of the *Mathematicks*, and of *Natural Philoſophy*, tho' indeed not very evident, are not the leſs ſolid or real. If Men were only to be conſider'd in their Natural State, nothing is more uſeful to them, than that which tends to preſerve Life, and to produce thoſe Arts which are ſo neceſſary and ſo ornamental to Society.

That which relates to the Preſervation of Life, is particularly the Object of *Natural Philoſophy*; and with this view it is divided by the Society into three Branches, which makes three different kinds of Profeſſors, *Anatomy*, *Chymiſtry* and *Botany*. It is eaſie to ſee, how greatly it imports us to know exactly Humane Bodies, and the Remedies or Medicines that may be drawn from *Plants* and *Minerals*.

As for the *Arts*, the Reckoning up of which would be infinite, ſome of 'em depend upon *Natural Philoſophy*, and others upon *Mathematicks*.

It ſeems at firſt that if one would only regard what is profitable in *Mathematicks*, one ſhould not cultivate them any farther, than as they have an immediate and ſenſible Relation to *Arts*, and leave all the reſt as a vain Theory: But ſuch an Idea of the *Mathematicks* would be very falſe.

The Art of *Navigation*, for inſtance, has a neceſſary Connexion with *Aſtronomy*; on which Account, the Study of the latter can never be carried too far for the Intereſt of the former. *Aſtronomy* has an indiſpenſible occaſion of *Opticks*, on account of long Perſpective-Glaſſes; and both the one and the other, as well as all the Parts of *Mathematicks*, are founded upon *Geometry*; and if you will go to the end of 'em, even upon *Algebra* it ſelf.

Geometry, and eſpecially *Algebra*, is the Key of all the Enquiries that can be made into *Magnitude.* Theſe Sciences, which do only concern themſelves with abſtracted Relations and ſimple Idea's, may appear unfruitful, ſo long as they do not go out, as one may ſay, of the Intellectual World; but mixed *Mathematicks*, which deſcend to Matter, and which conſider the *Motions* of the *Stars*, the *Augmentation* of *Moving Powers*, the different Ways made by the *Rays* of *Light* in different *Mediums*, the different Effects of *Sound* by the *Vibrations* of *Strings*, in a word, all the Sciences that diſcover the particular Relations of ſenſible *Magnitudes*, go ſo much the farther, and with ſo much greater Certainty, as the Art of diſcovering Relations in general is more perfect. An univerſal Inſtrument cannot have too great an Extent, nor be too handy, nor too eaſie to be applied to every thing we deſire to obſerve; it is ſo uſeful, that no Science can be without its Aſſiſtance; for which reaſon it is, that among the *Mathematicians* of the *Academy*, from whom the Publick is to expect any Advantage, the *Geometricians*, or *Algebraiſts* make one Claſs, as well as the *Aſtronomers* and the *Mechaniſts*.

Nevertheleſs it is true, that all the Speculations of pure *Geometry* or *Algebra* are not applicable to uſeful things; but it is true alſo, that the moſt part of thoſe which are not immediately applicable, do lead to, or are connected with thoſe that are ſo. To know, that in a Parabola the *Sub-tangent* is double to the *Cor-*

Correſpondent Abſiſſe, is a Knowledge very barren in it ſelf; but for all that, one cannot without it attain to the Skill of throwing *Bombs* with that Exactneſs of which we are now Maſters. In the *Mathematicks*, there are much fewer evident Uſes, than Propoſitions or Truths; and it is well if the Concurrence of ſeveral Truths do always produce one ſingle Uſe. Moreover, there are *Geometrical* Speculations, which tho' not immediately applicable to any thing uſeful, may in the Conſequences become ſo. When the greateſt *Geometricians* in the Seventeenth Century ſet themſelves to Study a new *Curve*, which they called a *Cycloide*, it was at firſt but a pure Speculation, to which they were excited by the Vanity of excelling each other in the Diſcovery of different Theorems: They themſelves did not pretend to labour for the Publick Good; and yet it has happened, that their diving thus into the Nature of the *Cycloide* has been the occaſion of advancing *Pendulums* to the utmoſt Perfection, and meaſuring Time with the greateſt Exactneſs.

It is the ſame with *Philoſophy* as with *Geometry*. The *Anatomy* of *Animals* ſhould ſeem to be a very indifferent matter to us, we are only concerned to know the Humane Body: But ſuch a part, which in the Bodies of Men is of ſo nice or ſo confuſed a Structure as renders it inviſible, becomes ſenſible and manifeſt in the Bodies of other Animals. Hence it is, that even Monſters themſelves are not to be ſlighted. The Mechaniſm that is concealed in one Species of Creatures, or in a common Structure, may be diſcloſed in another Kind, or in an extraordinary Compoſition; and one would be apt to ſay that Nature by multiplying and diverſifying her Works, cannot ſometimes avoid diſcovering her own Secret.

The Ancients knew the *Load-ſtone*, but they were acquainted with no other Quality of it, ſave that of *attracting Iron.* Whether it was, that they did not much value a Curioſity which led them to nothing, or whether they had not the Genius of making Experiments, it is certain they did never examine the Nature of this Stone with the Attention that was due to it: One ſingle further Experiment might have taught 'em, that it turns of it ſelf towards the Poles of the World, and had thrown into their Hands the ineſtimable Treaſure of the Sea-Compaſs. They did in a manner touch the important Diſcovery and let it go again; and if they had allowed a little more time to a Curioſity which ſeemed unprofitable, the hidden Advantage would ſoon have diſcovered it ſelf.

Let us always be heaping up *Mathematical* and *Phyſical* Truths, and let what will come of it, the Riſque cannot be great: This is certain, that out of ſuch a Stock, a great number have ariſen which have been found to be exceeding uſeful: We may juſtly preſume that we ſhall draw a great many from the ſame *Well*, ſhining even at their Birth with a ſenſible and undoubted Profit; others there will be, that muſt ſtay ſome time, till they be ripen'd and their Uſe diſcover'd by a careful Meditation, or a lucky Chance: There will be others, which, taken ſingly, may appear barren, and perhaps will not be otherwiſe till we think of coming near them: Laſtly, and at the worſt, there may be ſome alſo that ſhall remain for ever uſeleſs.

I mean uſeleſs with reſpect to Senſible and, as I may ſay, coarſe Uſes, for otherwiſe they will not be ſo. An Object, towards which we turn our Eyes only, becomes more clear and more illuſtrious when the neighbouring Objects, which we do not however look upon, are enlighten'd as well as it; for it takes advantage of the Light, which they communicate to it by Reflexion. Thus the Diſcoveries that are viſibly uſeful, and which ſeem only to deſerve our chief Attention, are in ſome manner illuſtrated by others that are thought uſeleſs. All Truths are enlighten'd by each other.

It is always uſeful to think right, even upon uſeleſs Subjects. Tho' Numbers and Lines ſhould abſolutely lead us to nothing; yet they would always be the only certain Sciences that are beſtowed upon our Natural Lights, and they would ſerve to furniſh our Reaſon more ſurely with the firſt Habitude, and the firſt Turn towards Truth: They would teach us to work up Truths to catch the firſt Thread of them, tho' often exceeding fine and almoſt imperceptible, and to follow it as far as it could lead us; in a word, they would render Truth ſo familiar to us, that upon other occaſions we might diſcover it with the firſt caſt of the Eye, and, as it were, almoſt by Inſtinct.

The Geometrical Genius is not ſo confined to *Geometry*, but that it may be drawn away from it, and applied to other Sciences. A Work of Morality, of Politicks, of Criticiſm, perhaps of Eloquence it ſelf, will be more beautiful, all other Things being equal, if it be performed by the Hand of a *Geometrician.* The Order and Regularity, the Method and Exactneſs, which ſhine in good Books of late, may be firſt owing to that Geometrical Spirit, which ſpreads it ſelf more than ever, and which in ſome manner draws nearer and nearer, even to thoſe that do not underſtand Geometry.

Sometimes a Great Man gives the Mode to all thoſe of his own Age; and he to whom the Glory of eſtabliſhing a new Manner of Reaſoning is moſt juſtly due, may appear to have been ſome excellent Geometrician.

Laſtly, Every thing that raiſes us to Reflections, which altho' purely Speculative, are Great and Noble, is an Advantage which may be named Spiritual and Philoſophical; for the Mind has its Wants as well as the Body, and they are perhaps of as large an Extent too. It will *know*, and all that can be *known* is neceſſary to it; and nothing proves more plainly how much it is deſtined to the finding out Truth; nothing perhaps is more Glorious for it than the Pleaſure it taſts, and ſometimes, in ſpight of it ſelf, in the dryeſt and moſt thorny Study of *Algebra*.

But without changing the common Idea's of Things, and without having recourſe to Advantages that may appear too ſubtile and too refined, we may poſitively aſſert, that both the *Mathematicks* and *Philoſophy* have Parts in them which are only curious, and this is common to them, with other Sciences, that are generally allowed to be very uſeful, ſuch as *Hiſtory*, &c.

Hiſtory does not furniſh, in its utmoſt Extent, Examples of Virtue, nor Rules for the Conduct of our Lives: Beſides which, it is only a Repreſentation of perpetual Revolutions in Humane Affairs, of the Riſe and Fall of Empires, of Manners, Cuſtoms,

ſtoms and Opinions, which are continually ſucceeding one another; in a word, of all that rapid Motion, which altho' inſenſible, whirls every thing about with it; and is always changing the Face of the Earth.

If we would ſet one Curioſity againſt another, we ſhall find, that inſtead of this Motion which toſſes about Nations and overturns States, producing others out of their Ruin, *Philoſophy* conſiders the great and univerſal Motion, by which the whole Courſe of Nature is put into Order, which has hung up the heavenly Bodies in different Spheres, which kindles and extinguiſhes the Stars, and which by always following unchangeable Laws, produces an infinite variety of Effects. If the amazing Difference of the Manners and Cuſtoms of Nations is ſo agreeable to be reflected on, it muſt alſo be an extreamly great Pleaſure to conſider the vaſt Diverſity in the Compoſition of the different Kinds of Animals, with reſpect to their different Functions, to the Elements where they live, to the Climates they inhabit, and to the Food by which they are ſubſiſted. The moſt curious Stroaks in Hiſtory can hardly be compared to the *Phoſphori*, to *cold Liquors*, which being mingled together, produce *Heat* or *Flame*; to *Trees* of *Silver*; to the almoſt *Magical* Sports of the *Load-ſtone*; and an infinite number of Secrets that Art has diſcovered, by watching cloſely, and curiouſly prying into Nature. In a word, *Philoſophy* traces and unravels, as much as poſſible, the Footſteps of that infinite Wiſdom and Underſtanding which has produced all Things; whereas *Hiſtory* has only for it Objects the irregular Effects of the Paſſions and Caprices of Men, and a train of Events ſo whimſical, that it was formerly ſuppoſed, that they were governed and directed by a blind and ſenſeleſs Divinity.

We muſt not count among the ſimple Curioſities of *Natural Philoſophy*, thoſe ſublime Reflections upon the Author of the Univerſe, to which it directly leads us. That great Work, always more wonderful in proportion to its being better known, give us ſo high an Idea of its Author, that we perceive our Minds overwhelmed with Admiration and Reſpect.

Above all, *Aſtronomy* and *Anatomy* are the two Sciences which do moſt ſenſibly offer to our Thoughts two great Characters of the Creator; the one his *Immenſity* by the *Diſtances*, *Magnitude* and *Number* of *Heavenly Bodies*; the other, his *infinite Wiſdom* by the *Mechaniſm* of *Animals*. Thus true Philoſophy is exalted even to a kind of *Theology*.

The different Views of the Mind of Man are almoſt infinite, and Nature is quite ſo: So that we may daily expect Diſcoveries either in *Mathematicks* or *Phyſicks*, that will procure us new Kinds of Profit or Pleaſure. Reckon up all the different Uſes that could be made of the *Mathematicks* about a hundred Years ago, none of 'em come near the *Glaſſes* with which they have furniſhed us ſince that Time, and which are a new Organ of Sight, that we durſt not have expected from the Hands of Art. How great would have been the Surprize of the Ancients, if any one had told 'em, that their Poſterity would one Day, by the help of certain Inſtruments, have diſcovered an infinite number of Objects, which they were not capable of ſeeing; a *Heaven* unknown to them, *Plants* and *Animals* of which they did not ſo much as expect the Exiſtence?

ſtence? The Naturaliſts had already made a great number of Curious Experiments, but the Invention of the *Air-Pump* has within half a Century produced a vaſt Number more of a quite new Nature, and which by ſhewing us Bodies in a *Space void of Air*, repreſents them to us as tranſported into a World different from our own, in which they experience ſuch Changes as we could have formed no Notion of. Perhaps the excellent *Geometrical* Methods which are invented or brought to Perfection from time to time, will at laſt ſhew us the End of *Geometry*, that is to ſay, the Art of making Diſcoveries in that Science, which is all; but Philoſophy, that contemplates an Object of an unbounded variety and fruitfulneſs, will always find Obſervations to make, and Occaſions of enriching it ſelf, and will keep the Advantage of being a Study that can never be quite compleated.

So many things that remain ſtill, and which will probably always remain to be known, give a handle to the affected Diſcouragement of thoſe who do not care to enter among the Thorns of Phyſicks. And in order to render natural Knowledge contemptible, People often fall into an Admiration of Nature, and maintain that ſhe is incomprehenſible. In the mean time Nature is never ſo wonderful, nor ſo much eſteemed, as when ſhe is beſt underſtood: It is true, that that which is known is very little in Compariſon of that which remains yet unknown; ſometimes even that which we do not know, is juſt what it ſeems we ought chiefly to apply our ſelves to. For inſtance, we do not know, at leaſt not certainly, why a Stone thrown up into the Air falls back again; but we know very well the Cauſe of the *Rainbow*, why it never exceeds a certain Heighth; why its Breadth is always the ſame; why when there are two Rainbows at once, the Colours of one are turned up-ſide down with reſpect to the other, *&c.* and yet how much more ſimple a Phenomenon does the Fall of a Stone from the Air appear, than that of a Rainbow? but however, tho' we do not know all, yet we are not ignorant of all neither; tho' we are ignorant of that which appears to the moſt ſimple, yet we underſtand ſome of thoſe Things that are of a more complex'd Nature; and if we ought to fear that our Vanity often flatters us with the Hopes of attaining the Knowledge of things that are not made for us, it is no leſs dangerous, if we ſuffer our ſelves ſometimes to be perſwaded by our Sloth, that we are condemned to a State of greater Ignorance than we really are.

We may be allowed to reckon that the Sciences are but juſt born, either, becauſe that among the Ancients they were always in a very imperfect Condition, or becauſe their Footſteps have been almoſt wholly worn out, during the long Darkneſs of the barbarous Ages; or, laſtly, becauſe we were not got into the right way of tracing 'em till within a Century. If we ſhould examine hiſtorically the Progreſs they have already made, in ſo ſhort a ſpace of Time, in ſpight of the falſe Prejudices that they were forced to break thro' on all Sides, and which have long reſiſted 'em, ſometimes even in ſpight of the ſtrange Obſtacles of Authority and Power; in ſpight of the little Zeal that People have had for Knowledges remote from common Cuſtoms; in ſpight of the ſmall number of Learned Men, who have devoted themſelves to ſuch Labours, in ſpight of the weak Motives to engage them therein; we ſhould be aſtoniſh'd at the Greatneſs and Swiftneſs of their Progreſs, ſeeing ſo many new ones produced, as it were, out of nothing, inſomuch that we ſhould carry our Hopes too far perhaps for the time to come.

The more Hopes we have that our Advances will be happy, the more we are obliged to conſider the Sciences, at leaſt that of Natural Philoſophy, as lying at preſent in their Cradle. Wherefore the Buſineſs of the *Academy* is only as yet to make an ample Proviſion of Obſervations and well-atteſted Facts, which may be one Day the Foundation of a Syſtem; for Syſtematical Philoſophy muſt ſtay till the Experimental furniſhes her with neceſſary Materials, before ſhe proceed to Building.

For ſuch a Collection of Materials, nothing but Societies, and thoſe too encouraged by the Prince, can ſucceed in making and preparing it: Neither the Lights, neither the Cares, nor the Life, nor the Purſe of any Private Man are equal to it. There is required too great a Number of Experiments, and of two many different Kinds, and a too frequent Repetition of the ſame, too great a Variation of the Manner of 'em, and too much Time to be ſpent in them for any one Man whatever. The Cauſe of the leaſt Effect is almoſt always involved in ſo many Folds and Intricacies, that unleſs one unravels them with vaſt care, one muſt not hope that they will diſcloſe themſelves.

At preſent the *Academy of Sciences* does not ſet about Nature but in little Parcels: No general Syſtem for fear of falling into thoſe raſh ones, which do but too well accommodate the Impatience of our Minds, and which being once eſtabliſhed do oppoſe the Truths that preſent themſelves to our View. To Day we make ſure of one Fact, to Morrow of another that has no Relation to the former. We venture ſometimes to gueſs at Cauſes, but then we produce 'em for no more than Conjectures. Thus the Collection which the Academy offers to the Publick, is compoſed of Pieces that are looſe and independent on each other, of which each private Man, who is the Author, is reſponſible for the Facts and Experiments, and of which the Society does not allow the Concluſions, but with all the Reſtrictions of a *diſcreet Scepticiſm.*

The time will come, perhaps, that theſe ſcatter'd Members may be brought into a regular Body, and if they are ſuch as we wiſh them, they will almoſt form themſelves; ſeveral diſtinct Truths, as ſoon as they are in a ſufficient Number, do ſo lively offer to the Mind their Relations and mutual Dependencies, that it ſhould ſeem, that after having been ſeparated from each other, by a kind of Violence, they naturally endeavour to be re-united.

RULES and ORDERS
Appointed by the
KING
FOR THE
GOVERNMENT
OF THE
Royal Academy of Sciences.

THE King being deſirous to give Marks of his Affection to the *Royal Academy of Sciences*, has reſolved upon the following Regulations, which his Majeſty expects ſhall be punctually complied with.

I.

THE *Academy* ſhall always remain under the Protection of the King, and receive his Orders by ſuch of the Secretaries of State, as his Majeſty ſhall appoint to deliver them.

II. THE

II.

THE ſaid *Academy* ſhall always be compoſed of four Sorts of *Academiſts*, *Honoraries*, *Penſioners*, *Aſſociates* and *Pupils*; the firſt Claſs to be compoſed of Ten Perſons, and the three others of Twenty each; and none ſhall be admitted into any of theſe four Claſſes, but by the Choice and Approbation of his Majeſty.

III.

THE *Honoraries* ſhall always be Inhabitants of the Kingdom, and recommendable by their Skill in the *Mathematicks*: One of theſe ſhall be *Preſident*; but all of 'em excluded from being *Penſioners*.

IV.

THE *Penſioners* ſhall always be Inhabitants of *Paris*; three of 'em *Geometricians*, three *Aſtronomers*, three *Mechaniſts*, three *Anatomiſts*, three *Chymiſts*, three *Botaniſts*, one *Secretary*, and one *Treaſurer*; and when it ſhall happen that any one of theſe is called to any Office or Employment, obliging him to live out of *Paris*, his Place ſhall be filled up by another, in the ſame manner as if he were Dead.

V.

AMONG the *Aſſociates*, conſiſting of the like number as the *Penſioners*, Twelve ſhall always be Inhabitants of the Kingdom, two of whom ſhall apply themſelves to *Geometry*, two to *Aſtronomy*, two to the *Mechanicks*, two to *Anatomy*, two to *Chymiſtry*, and two to *Botany*: The eight remaining may be Foreigners, and allowed to apply themſelves to ſuch of the above-mentioned Sciences, as ſhall be moſt ſuitable to their Genius and Studies.

VI.

THE *Pupils* ſhall be ſuch as are ſettled in *Paris*, and each of them muſt apply himſelf to that particular Science of which the *Penſioner-Academiſt*, under whoſe Tuition he is put, ſhall make Profeſſion: And if they ſhould be called to any Employments, requiring them to reſide in ſome other Place, their Offices ſhall be vacant as if they were Dead.

VII.

To fill the Place of an *Honorary* Member, the Society ſhall chuſe by Plurality of Voices, a Perſon to be recommended to the King for his Approbation.

VIII.

To fill the Place of a *Penſioner*, three Perſons ſhall be named, of whom two at leaſt are to be *Aſſociates* or *Pupils*, and their Names ſhall be laid before his Majeſty, to the end, that he may chuſe one out of 'em.

IX.

To fill the Place of an *Aſſociate*, the *Academy* ſhall chuſe two Perſons, one of whom, if not both, to be taken out of the Number of the *Pupils*, and their Names laid before the King, that he may be pleaſed to chuſe one of them.

X.

To fill the Place of a *Pupil*, each of the *Penſioners* may chuſe one, whom he ſhall offer to the Society for their Conſideration, and he upon whom the Majority of Voices falls, ſhall be propoſed to his Majeſty.

XI.

No Perſon ſhall be propoſed to the King, in order to be put into any of the abovementioned Places of *Academiſt*, unleſs he be a Man of ſound Morals and known Probity.

XII.

No Man that is a *Regular Eccleſiaſtick*, or belongs to any Order of Religion, ſhall be propoſed; unleſs it be to fill the Place of an *Honorary Academiſt*.

XIII.

None ſhall be propoſed to the King, for the Places of *Penſioner* or *Aſſociate*, but ſuch as have diſtinguiſh'd themſelves by ſome conſiderable Work which they havepubliſhed; by ſome Courſe made with Reputation in the Science they profeſs; by ſome Machine of their own Invention; or ſome particular Diſcovery.

XIV.

None ſhall be propoſed for the Places of *Penſioner* or *Aſſociate*, unleſs they have attained to the Age of 25 Years at leaſt.

XV.

None ſhall be propoſed for the Places of *Pupil*, unleſs they be at leaſt 20 Years old.

XVI.

The ordinary Meetings of the *Academy* ſhall be kept in the *King's Library* every *Wedneſday* and *Saturday*; but if either of theſe Days happen to be a Holiday, the Meeting ſhall be the Day before.

XVII.

Each Meeting ſhall laſt at leaſt two Hours, that is to ſay, from Three to Five in the Afternoon.

XVIII.

THE Receſſes or Vacations of the *Academy* ſhall begin upon the 18th of *September*, and end the 11th of *November*, beſides which there ſhall be no Meetings during the 15 Days of *Eaſter*, *Whitſon*-Week, and from *Chriſtmas* to *Twelfth-day*.

XIX.

THE *Academiſts* ſhall diligently attend at every Meeting; and none of the *Penſioners* be abſent above two Months for his own particular Affairs, without his Majeſty's expreſs Leave, unleſs it be in the time of the Vacations.

XX.

IT having been found by Experience, that there are a great many Inconveniencies in theſe Works to which the *Academiſts* apply themſelves in common; each one ſhall chuſe a particular Object of his Studies, and by the Account he ſhall give of it in the Meeting; he ſhall endeavour to enrich the *Academy* by his Diſcoveries, and improve himſelf at the ſame time by their Obſervations.

XXI.

AT the beginning of each Year, every *Penſioner Academiſt* ſhall be obliged to give an Account in Writing to the reſt of the Body, what Work he deſigns chiefly to engage in; and the other *Academiſts* ſhall be deſired to give the like Declarations of their Deſigns.

XXII.

THO' each *Academiſt* be obliged to apply himſelf chiefly to ſuch things as relate to the particular Science in which he is engaged; yet every one ſhall be exhorted to extend his Enquiries into all that may be uſeful and curious in the ſeveral Parts of the *Mathematicks*, in the different Courſe of Arts, or that may any way relate to the Knowledge of *Natural Hiſtory* and *Philoſophy*.

XXIII.

AT every Meeting, two at leaſt of the *Penſioners Academiſts*, ſhall be obliged, in their turns, to bring ſome of their particular Obſervations; as for the *Aſſociates*, they ſhall always have the Liberty to propoſe theirs likewiſe; and all that are preſent, whether *Honorary Penſioners*, or *Aſſociates*, may, according to the Order of their Science, make their Remarks upon what has been propoſed; but the *Pupils* ſhall only ſpeak when they are deſired by the *Preſident*.

XXIV.

ALL the Obſervations brought by the *Academiſts* to the Meetings, ſhall be by them, the ſame Day, delivered in Writing to the *Secretary*, to the End, that Recourſe may be had to them upon occaſion.

XXV.

ALL the *Experiments* that ſhall be related by any *Academiſt*, ſhall be repeated by him, if poſſible, at the Meeting, or at leaſt at Home in private, when ſome of the *Academiſts* are preſent.

XXVI.

THE *Academy* ſhall take great care, that upon all occaſions, when the Members happen to be of different Opinions, no Expreſſions of Anger or Contempt be uſed by them againſt each other, neither in Diſcourſe nor Writing: and whenever they happen to oppoſe the Sentiments of any Learned Men whatever, they ſhall be exhorted to ſpeak of him with Reſpect.

XXVII.

THE *Academy* ſhall take care to maintain a Coreſpondence with all the Learned Men, either in *Paris*, or other Provinces of this Kingdom, or even in foreign Countries, to the end, that they may be readily informed of all that paſſes, either in *Mathematicks* or *Phyſicks*; and when they come to fill up the Vacancies of Members, Preference is given to thoſe Learned Men who have been moſt punctual in ſuch kind of Correſpondencies.

XXVIII.

THE *Academy* ſhall appoint ſome of their Members to read all the valuable Pieces that appear in *Phyſicks* or *Mathematicks*, whether in *France* or elſewhere; and the Perſon to whom any ſuch Pieces is referr'd, ſhall make his Report to the Company without Criticiſing upon it, and only repreſent what may be uſeful in it.

XXIX.

THE *Academy* ſhall repeat all the conſiderable Experiments that have been made elſewhere, and ſhall note upon their Books the Conformity or Difference between their own, and others Obſervations.

XXX.

IF any of the Members propoſe to Print a Book, it ſhall be firſt ſubmitted to the Examination of the *Academy*; and no Approbation of it ſhall be given, till it has been quite read in the Publick Meetings, or at leaſt not till after an Examination and Report of it has been made by ſuch Perſons to whom it ſhall have been referr'd: And none of the Members ſhall put his Title of *Academiſt* at the Head of any Work which he Publiſhes, unleſs it has been thus firſt approved by the *Academy.*

XXXI.

THE *Academy* ſhall examine, if his Majeſty orders it, all the *Machines* for which his Patent or Priviledge is deſired by the Inventors, and ſhall certifie whether they be New and Uſeful; and the Inventors of ſuch as have been approved ſhall be obliged to leave a Model with the *Academy.*

XXXII.

THE *Honorary Penſioners* and *Aſſociates Academiſts*, ſhall have Voices when the Debate is only about Sciences.

XXXIII.

THE *Honorary* and *Penſioner Academiſts* ſhall have Voices in all Elections, and other Affairs relating to the Society, and all ſhall be determined by Balotting.

XXXIV.

SUCH as are not of the *Academy* may not aſſiſt, nor be admitted into the Ordinary Meetings, unleſs it be when they are introduced by the *Secretary*, in order to propoſe ſome New *Machine*, or other Diſcovery.

XXXV.

EVERY Body ſhall be admitted into the Publick Meetings, which are to be held twice a Year, the firſt the Day after St. *Martins*, and the other the Day after *Eaſter*.

XXXVI.

THE *Preſident* and the *Honorary* Members ſhall ſit at the upper end of the Table: The *Penſioners* on each ſide of the Table, the *Aſſociates* at the lower end, and the *Pupils* each one behind the *Academiſt* to whom he belongs.

XXXVII.

IT ſhall be the care of the *Preſident*, that good Order be kept at every Meeting; and he ſhall give an exact Account to the King, or to that Secretary of State, to whom his Majeſty ſhall refer him, of all Matters relating to the *Academy*.

XXXVIII.

IN all Meetings, the *Preſident* ſhall cauſe the different Matters to be fairly Debated, take the Opinion of every one that has a right of Voting according to their Order, and ſhall determine the Queſtion by the Plurality of Voices.

XXXIX.

THE King ſhall appoint a *Preſident* the firſt Day of every Year; but tho' a new Nomination be neceſſary each Year, yet he may be continued during his Majeſty's Pleaſure; and whereas the ſaid *Preſident* may be obliged to be abſent ſometimes, either thro' Indiſpoſition, or on account of his private Affairs, the King will be pleaſed at the ſame time to appoint another *Academiſt*, who ſhall ſupply the *Preſident*'s Abſence.

XL.

THE *Secretary* ſhall be very punctual in Collecting the Subſtance of all that is propoſed, debated, examined and reſolved in the Meetings, and ſhall enter an Account of it in the Journal of each Day, and regiſter the Books or Papers that have been read: He ſhall Sign all the Accounts that ſhall be given thereof, either to the Members of the Society, or to any others that may be concerned to have them; and every Year at the end of *December*, he ſhall publiſh an Extract from his *Regiſters*, or a *Rational Hiſtory* of the moſt remarkable *Tranſactions* of the Society.

XLI.

THE *Regiſters*, *Titles* and *Papers* concerning the *Academy*, ſhall always reamain in the Hands of the *Secretary*, to whom they ſhall be deliver'd by an Inventory, which the *Preſident* ſhall make of them: And at the end of every Year, the ſaid Inventory ſhall be collated by the *Preſident*, and augmented with every thing that has been brought in, during the ſaid Year.

XLII.

THE *Secretary* ſhall be perpetual, and when thro' Sickneſs, or any other juſt Cauſe, he be hindred from attending, he may appoint ſuch of the *Academiſts* as he thinks fit, to take the Minutes in his ſtead.

XLIII.

THE *Treaſurer* ſhall keep all the *Goods*, *Books*, *Inſtruments*, *Machines*, and other *curious* Things belonging to the *Academy*; and when he enters upon his Office, the Preſident ſhall deliver them all to him by an Inventory; and at the end of every Year, he ſhall inſert into the ſaid Inventory all that has been added ſince the laſt Year.

XLIV.

WHEN any Learned Man ſhall deſire to ſee any of the Things committed to the Cuſtody of the *Treaſurer*, he ſhall take care to ſhew them; but he ſhall permit nothing to be taken from the Place where it is kept, without an Order in Writing from the *Academy*,

THE

XLV.

THE *Treaſurer* ſhall be perpetual, and when thro' any Lawful Impediment he cannot fulfil the Duties of his Place, he may ſubſtitute ſome *Academiſt* during his Abſence.

XLVI.

TO facilitate the Impreſſion of the ſeveral Works that may be compoſed by the *Academiſts*, the King allows them to chuſe a *Bookſeller*, to whom, in Conſequence of ſuch Choice, his Majeſty will grant the neceſſary Priviledges for Printing and Diſperſing the Works of any Member as ſoon as they ſhall be approved of by the *Academy*.

XLVII.

FOR encourageing the *Academiſts* to continue their Labours, his Majeſty will continue to pay them their Ordinary Penſions; and will moreover grant them extraordinary Gratifications, in proportion to the Merit of their Works.

XLVIII.

FOR the Aſſiſtance of the *Academiſts* in their Studies, and to facilitate the Means of perfecting their reſpective Sciences, the King will continue to allow the neceſſary Charges for making the ſeveral *Experiments* and *Diſcoveries* of every *Academiſt*.

XLIX.

TO recompence the diligent Attendance of Members, at the Meeting of the *Academy*, the King will diſtribute at every Meeting forty *Jettons* to all the Penſioners as ſhall be then preſent.

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IT is his Majeſty's Pleaſure, that the preſent Regulation be read at the next Meeting, and entered into the Books, to the End, that it may be punctually obſerved according to the Form and Tenor thereof; and if any of the Members neglect or refuſe to comply therewith, the King will cauſe him to be puniſhed according to the Nature of the Caſe.

Done at Verſailles, 26. Jan. 1699.

Signed *LEWIS.*

And lower, *Phelypeaux.*

By Vertue of this Regulation, the *Academy of Sciences* became a Corporation, eſtabliſhed by Royal Authority.

It is a very numerous Body, including under different Titles the moſt famous Perſons in any of the Sciences, and even ſuch as are like to become ſo.

Among them are to be found, not only the moſt Learned in all the Provinces of *France*, but alſo thoſe of other Countries.

The *Academy* is continually recruited from within it ſelf; and thoſe who may in time become the Principal Members, may begin early to form themſelves for it.

At the ſame time there is always room for Strangers of Merit.

The *Academy* has Correſpondents in all Places where there are Sciences, and draws to it ſelf the firſt News, and the firſt Fruits of moſt of the Diſcoveries that are made Abroad.

The different Methods of coming into this Body are proportioned to the different Views of thoſe who deſire to come in, and to the different Claſſes of the *Academiſts.*

By theſe Regulations, the Members are engaged more ſtrongly than ever to their reſpective Labours, and even to great Diligence therein.

The *Academy* does alſo become hereby much more known to the Publick, as well as the Buſineſs in which it is engaged, and the Taſte, the Fruit and the Spirit of Sciences may be much more eaſily communicated Abroad.

After that the Regulations had been read in the Aſſembly, the *Abbot Bignon* communicated the following LETTER from Monſieur de *Pontchartrain* to him the ſaid Abbot.

SIR,

IN *Conſequence of the Regulations made by the King, the Twenty ſixth Inſtant, for the* Royal Academy of Sciences, *I have laid before his Majeſty a Liſt of the Members, who at preſent compoſe that Body*, viz. *you yourſelf, Sir, the* Marquis de L'Hopital, *the Father* Trutchet, *Captain* Renau, *Monſ. de* Mallezieu, *Father* Malebranche, *and Father* Gouye, Honorary Academiſts: *Abbot* Gallois, *the Sieur* Rolle *and the Sieur* Varignon, Geometricians; *the Sieurs* Caſſini, de la Hire *and* Le Fevre, Aſtronomers; *the Sieurs* Filleau des Billets, Jaugeon *and* Daleſme, Mechaniſts; *the Sieurs* du Hamel, du Verney *and* Mery, Anatomiſts; *the Sieurs* Bourdelin, Homberg, *and* Boulduc, Chymiſts; *the Sieurs* Dodart, Marchand, *and* Tournefort, Botaniſts; *the Sieur de* Fontenelle, Secretary; *the Sieur* Couplet, Treaſurer;

and Penſioners; *the Sieurs* Liebnitz, Tſchirnaus, *and* Guilellmini, *Foreigners*; *the Sieurs* Maraldi *and* Regis, Geometricians; *the Sieurs* Caſſini *the Son*, *and* de la Hire *the Son*, Aſtronomers; *the Sieurs* Chazelles, *and* de Lagny, Mechaniſts; *the Sieurs* Tauvry, *and* Bourdelin *the Son*, Anatomiſts; *the Sieurs de* Langlade *and* Lemery, Chymiſts; *the Sieurs* Maurin de St. Victor, *and* Maurin Toulon, Botaniſts *and* Aſſociates: *Under the Sieur* Varignon, *the Sieur* Carreé, Pupil; *under the Sieur* Caſſini, Aſtronomer, *the Sieur* Monty, Pupil; *under the Sieur* Homberg, *the Sieur* Geofroy, Pupil; *under the Sieur* Couplet, *his* Son, Pupil. *His Majeſty was pleaſed to ſhew his particular Satisfaction of the Merit and Diligence of each of the above-mentioned Gentlemen, and does approve of and confirm them in their reſpective Places: But you muſt obſerve, that the Sieur* Dodart *is approved of for a particular reaſon, for, his Employment of* Phyſician *to the Princeſs of* Conti, *obliging him to live with that Princeſs out of* Paris, *according to the fourth Rule, he would be excluded from the Number of the* Penſioners; *nor would the King continue him in it, but for the reaſon above-mentioned, and for his long ſtanding in the* Academy, *but this ſhall not be made a Precedent. The King has moreover commanded me to let you know, that you ſhould immeditely proceed to the Election of Perſons fit for the Places that remain to be filled, according to the aforeſaid Regulations.* *I am Sir,*

Your moſt Affectionate,

And moſt Humble Servant,

Pontchartrain.

Verſailles the 28th, Jan. 1699.

As by this Letter, the King appointed ſeveral New Members; there was a very agreeable Confuſion (to which we were not accuſtomed) at the following Meeting: For both the Old Members, ſome of whom had not been very exact in their Attendance, failed not to be preſent; and all the New Ones did likewiſe take Poſſeſſion of their Places, which made a great Appearance in one of the ſmalleſt Chambers of the King's Library. But this Diſorder was quickly at an end, the Abbot *Bignon* having ranged all of them in their proper Places, by which means the learned Men of different Kinds, a *Geometrician*, for Example, and an *Anatomiſt* were ſet next each other; and as thoſe Gentlemen do not ſpeak the ſame Language, there was no danger of interrupting the Publick Buſineſs by Private Converſations.

At this Meeting, which was the firſt of the New *Academy*; the firſt thing conſider'd, was, the Obligations we lay under to Monſ. *Pontchartrain.* It was unanimouſly reſolved that we ſhould go in a Body, with the Abbot *Bignon* at the Head of us, to give him our moſt humble Thanks for the Eſtabliſhment he had been ſo kind to obtain of the King for us, and to deſire the Continuation of his Protection.

The *Academy* alſo appointed a Committee to wait upon the Abbot *Bignon*, their *Preſident*, with their Acknowledgments for the ſhare he had had in their Eſtabliſhment.

After which ſeveral Meetings were wholly ſpent in putting us into that Poſture which was required by our New Regulation.

They began by filling up the vacant Places of the *Honorary* and *Aſſociate Academiſts*, and of their *Pupils*, purſuant to their new Rules and Orders. The new *Honorary* Members propoſed by the *Academy*, and afterwards approved by the King, were, according to the Order of Time, the following Gentlemen: Monſieur *Fagon* the firſt *Phyſician* to His *Majeſty*, the Abbot *de Louvois*, and Monſieur *de Vauban*.

The new *Aſſociates*, according to the ſame Order, were Monſieur *Hartſoeker*, Meſſieurs *Bernoulli*, Brothers, Monſieur *Newton* and Mouſieur *Viviani*, Foreigners; the new *Pupils* were Monſieur *Burlet*, Doctor of Phyſick, under Monſieur *Dodart*; Monſieur *Berger*, Batchelor of Phyſick, under Monſieur *Tournefort*; Monſieur *Boulduc* the Son under his *Father*; Monſieur *Tuillier*, Batchelor of Phyſick, under Monſieur *Bourdelin*; Monſieur *Chevalier* under the Abbot *Gallou*; Monſieur *Littre*, Dr. of Phyſick, under Monſieur *Duhamel*; Monſieur *Poupart* under Monſieur *Mery*; Monſieur *Simon de Valhebert* under Monſieur *Fontenelle* the Secretary; Monſieur *Parent* under Monſieur *des Billettes*; Monſieur *de Senne* under Monſieur *Jaugeon*; Monſieur *Reneaume*, Batchelor of Phyſick, under Monſieur *Marchand*; Monſieur *Amontons* under Monſieur *le Fevre*; Monſieur *Du Torrar* under Monſieur *Rolle*; Monſieur *Lieutaud* under Monſieur *de la Hire*; Monſieur *du Verney* under his *Brother*; and Monſieur *de Beauvilliers* under Monſieur *Dalesme*; Monſieur *Sauveur*, who has been many Years in the *Academy*, was continued in the ſame, under the Character of a Veteran.

They next conſider'd about a *Seal* and a *Device* for the Company.

The *Seal* was a *Sun*, the Emblem of the King and of the Sciences, between Three *Fleur de Lys*; and the *Device* was a *Minerva*, encompaſſed with the Inſtruments of the Sciences and Arts, with this Latin Motto, *Invenit & Perficit.*

But among all theſe Preliminary Meetings, the moſt conſiderable was that, in which all the *Penſioner Academiſts* gave an account in Writing of the Works in which they were engaged, and when they hoped to finiſh them. This was a kind of a Vow which they made at this new Birth of the Society; and the greateſt Part of the *Aſſociates* and *Pupils* did the ſame, tho' they were not obliged to it. Some of thoſe *Academiſts* have already diſcharged their Promiſe, and their Works have appeared in Publick.

All the Members preſent did likewiſe name the ſeveral Perſons with whom they ſhould enter into a Correſpondence upon the Buſineſs of Sciences, whether in *France* or in Foreign Countries; and the *Secretary*, in the Name of the *Academy*, diſpatched Letters to all theſe Correſpondents, deſiring them to maintain a regular Commerce with the reſpective Members.

It was eaſie to obſerve that theſe Preliminaries, tho' unavoidable, appeared heavy to the Company, which was impatient to enter upon ſerious Buſineſs, at which at laſt it arrived, and from that time its *Hiſtory* takes notice of nothing elſe, but *Obſervations* and *Diſcourſes* propoſed in the Meetings.

But we muſt not paſs by one Fact which Gratitude and even the Glory of the *Academy* renders abſolutely neceſſary to be mentioned in our Hiſtory, and this is a new Favour beſtowed upon us by his Majeſty, who inſtead of the little and cloſe Chamber in his Library, has given us a ſpacious and magnificent Apartment in the *Louvre*; and the firſt Meeting after *Eaſter*, which according to the Regulations made in *February* 1699. was to be Publick, was held in the ſaid new Apartment.

THE LIVES OF THE *French Philoſophers,* Late MEMBERS of the *Royal Academy of Sciences.*

PART I.

The LIFE of Monſieur BOURDELIN.

Claudius Bourdelin, was born in the Year 1621, at a Place called *Villa Franca*, near *Lyons*; he loſt both Father and Mother whilſt he was very Young, and was brought to *Paris.* Being left in a dangerous Age and Country, he applied himſelf, of his own accord, to the Study of *Greek* and *Latin*, with a deſign to learn *Phyſick* and *Chymiſtry*, which have ſince been his only Employment during the ſpace of above 56 Years.

In a ſmall time he acquired a great Reputation, not only by his exact and faithful Preparation of Medicines, which he diſtributed to every Body at an equal and reaſonable Rate; but alſo by his Knowledge of Diſtempers, upon which, without any Fee, he gave modeſt and, very often, happy Advice, tho' he never poſitively aſſured any of his Patients that they ſhould recover; People put a very great Truſt in him. He did not approve of Bleeding excepting in the *Apoplexy*; and we have ſeen him cure, without that Method, a great number of acute and inflammatory Diſtempers, ſuch as *Pluresſies*, the *Defluxions* on the Breaſt, *Quinſies*, &c.

When the *Royal Academy of Sciences* was ſet up by Monſ. *Colbert*, in the Year 1666, who applied all his Care to chuſe proper Members, Monſ. *Bourdelin* was adopted into their Number, under the Character of *Chymiſt*, and he preſently applied himſelf, in Conjunction with Monſ. *Du Cloſs*, to enquire into the Mineral-Waters of the Kingdom. He afterwards made a great number of Experiments upon the Mixture of Juices of Plants, or Spirits and Salts of Minerals, with Arterial or Venous Blood, or with the *Bile*, *Gall* and *Lymph* of Animals. He traced the Analyſis of all the Plants he could procure with the utmoſt Diligence and Exactneſs, and has very much contributed to the Perfection of that Method, which the Academy had a mind to purſue as far as they could. He likewiſe attempted the Analyſis of Oyls, by the means of his Invention, which has diſcover'd, in a great meaſure, the Nature of that kind of mixed Bodies. In a word, he has ſhewn the Society near 2000 Analyſes of all ſorts of Bodies, and has either executed or invented the greateſt part of the Chymical Operations that have been made in that Society for more than thirty Years.

He died the 15. *October.* 1699. being aged about fourſcore Years, and met Death with all the Conſtancy of a Philoſopher, and a good Man.

He left two Sons, both of them Academicians, one of 'em Member of the *Academy of Sciences*, the other of that of *Inſcriptions*: His Place of *Penſionary Chymiſt* has been filled by Monſieur *Lemery*, who was his Aſſociate.

The LIFE *of Monſieur* TAUVRY.

D*Aniel Tauvry*, born in the Year 1669. was the Son of *Ambroſe Tauvry*, a Phyſician of the Town of *Laval.* His Father taught him Latin and Philoſophy, and he found in him ſuch happy Diſpoſitions towards Learning, that he made him diſpute publickly upon a Theſis in *Logick* at the Age of Nine Years and a half, and about a Year after, upon another General and Problematical Theſis in *Philoſophy.* Afterwards Monſieur *Tauvry*, the Father, who was Phyſician of the Hoſpital of *Laval*, taught his Son at the ſame time both the Theory of Phyſick, and the Practice alſo, upon the diſeaſed Perſons in the ſaid Hoſpital. But to the End that he might be yet better inſtructed in that Profeſſion, he ſent him to *Paris*, as ſoon as he was 13 Years old; and two Years after the Young Man was made Doctor of Phyſick in the Univerſity of *Angers*: During the three firſt Years after he had taken his Degree he ſet himſelf cloſe to the Study of *Anatomy*; and at the Age of Eighteen, publiſhed a Book called *Rational Anatomy*. I cannot forbear giving you the exact Periods of the Studies of ſo hopeful a young Man: From *Anatomy* he paſſed on to the Knowledge of Medicines, and compoſed his Treatiſe of *Medicaments* when he was but 21 Years Old. Some time after, upon the King's forbidding Foreign Phyſicians to practiſe, he preſented himſelf to the Faculty of *Paris*, and was by them admitted *ad eundem*: He doubled his Diligence in a Profeſſion which he had embraced, as it were from the Cradle; and as his Mind was fruitful in Reflections, and that his Reading and Experience continually furniſhed him with Matter, he publiſhed another Book, intituled, *The New Practice in acute Diſtempers, and all ſuch as depend on the Fermentation of Liquors.* This Work appeared in 1678.

I knew him about that Time, and conceiv'd a great Eſteem for him; I had the Honour to be a Member of the Academy, and a Right to name a *Pupil*; I thought I could not make a better Preſent to the Society, than that of Monſ. *Tauvry*; and tho' my Nomination did not do him ſo much Honour as he deſerved, yet his deſire of being admitted into ſuch an illuſtrious Body, made him wave that Scruple.

In 1699, the King honoured the Academy with a new Regulation, making ſeveral new Members, and advancing the old ones. 'Twas then that Monſieur *Taüvry* was raiſed from the Degree of *Pupil* to that of *Aſſociate*. Soon after he engaged againſt Monſieur *Mery*, in the famous Diſpute of the *Circulation* of the *Blood* in the *Fœtus*, and upon that occaſion publiſhed his *Treatiſe of the Generation and Nouriſhment of the Fœtus* in 1700. This Diſpute occaſioned perhaps the Diſtemper of which he died; for as his Adverſary was a great Man, he labour'd very hard, and robb'd himſelf of a great part of his Reſt to penetrate into the bottom of the Matter in Queſtion, and in the mean time continued the Practice of his Profeſſion. However it was, his Natural Diſpoſition to an *Aſthma* increaſed towards the Beginning of the Year 1701. He died of the *Phtiſick* in the Month of *February*, aged 31 Years and a half. It appears ſufficiently by what has been ſaid of him, that he had a great Vivacity and Penetration of Mind. To the great Skill he had in *Anatomy*, he joyned the Talent of happily gueſſing at the Uſe of Structures, and in general he had the Gift of framing Syſtems. It is very likely that he would have ſhined in the Practice of Phyſick, tho' he had neither Patrons, Clubs, nor Art to ſet himſelf out; his Merit began already to procure him an Admittance into ſeveral conſiderable Families, by which I know his Loſs has been much lamented. His Place of *Aſſociate* has been filled by Monſieur *Littre*, who was before the *Pupil* of Monſieur *Duhamel*.

The LIFE *of Monſieur* TUILLIER.

ADrian *Tuillier*, Son of Monſieur *Tuillier*, Regent Doctor of the Faculty of Phyſick at *Paris*, born 18. *Jan.* 1674. was at firſt deſigned for the Study of the Law, and began to diſtinguiſh himſelf therein at the Age of 22 Years; but his natural Inclination for Phyſick, ſoon induced him to abandon the Practice of the former; he applied himſelf therefore to the latter; and at the Age of 26. was admitted Regent Doctor with great applauſe.

He came into the Academy in the Year 1699. in the Quality of *Pupil* to Monſieur *Bourdelin*; and as Monſieur *Lemery* ſucceeded Monſieur *Bourdelin* in the Office of *Stipendiary Academiſt*, Monſieur *Tuillier* became his *Pupil* alſo.

In 1702. He was appointed Phyſician of the Hoſpital of *Keyſerwert*, and as the Siege of that place laſted a great while, by the vigorous Defence of the Marquis *de Blainville*, its Governour, Monſ. *Tuillier* had ſo many Sick and Wounded under his Care, that the Fatigue and Trouble thereof threw him into a continued malignant Fever, of which he died *June* 2. in the ſame Year.

His Place of *Pupil* to Monſ. *Lemery* was naturally filled by Monſ. *Lemery* the Son, who had been before the *Pupil* of Monſ. *Tournefort*.

The LIFE *of Monſieur* VIVIANI.

VIncentius Viviani, a Gentleman of *Florence*, was born in that City the 5*th* of *April*, 1622. at the Age of 16 Years he learn'd Logick, and his Preceptor, who was a Monk, told him that the beſt Logick was *Geometry*: And as the good Geometricians (who at this Day are not very common) were very rare at that Time, in all *Tuſcany* there was but one Maſter of the *Mathematicks*, who was alſo of a Religious Order, and under him Monſieur *Viviani* began his Study.

The great *Galileo* was at that Time very aged, and, according to his own Expreſſion, had loſt *thoſe Eyes, by which he had diſcovered a New World.* He had not however forſaken his Studies; neither his Inclination, nor his ſurpriſing Succeſs, would ſuffer him to leave off: He therefore made uſe of ſome young People, who ſerved him inſtead of Eyes, and whom he had the Pleaſure to Form. Monſieur *Viviani* had hardly ſtudied Geometry a Year, when he became fit to be taken in by *Galileo*, and as it were, to be adopted by him; which happen'd in the Year 1639.

About 3 Years after he likewiſe took into his Family the famous *Evangeliſta Torricelli*, and died about three Months after, at the Age of 77 Years; a rare Genius, and whoſe Name we ſhall always ſee at the Head of ſome of the moſt important Diſcoveries upon which our Modern Philoſophy is founded.

Monſieur *Viviani* had then lived three Years with *Galileo*, that is to ſay, from 17 to 20. being happily born for the Sciences, and full of that vigour of Mind which Youth produces, it is not ſtrange he profited extreamly by the Leſſons of ſo excellent a Maſter; but it is much more ſo, that notwithſtanding the great Diſproportion of their Age, he had conceived a paſſionate Friendſhip, and lively Tenderneſs for his Maſter *Galileo*: He calls himſelf, every where, the Scholar, and the laſt Scholar too, of the great *Galileo*, for he has long ſurvived his Collegue *Torricelli*: He never put his Name to any of his Works, but with that Character, and always took an occaſion to mention his great Maſter, and ſometimes even, (which ſhews the Sincerity of his Heart) without any Neceſſity: He never named the Name of *Galileo*, without paying Homage to it; and one may eaſily perceive that he did not do it with any Deſign of equaling himſelf to that great Perſon, or to derive any part of his Merit upon himſelf; the Stile of *Tenderneſs* is eaſily diſtinguiſhable from that of *Vanity*.

After the Death of *Galileo* he ſpent two or three Years in the Study of Geometry, without any Interruption, and it was then that he formed the Deſign of his *Divination upon Ariſteus*. To explain the Meaning of that Divination, we muſt trace a little back the Hiſtory of the Ancient Geometricians.

Pappus of *Alexandria*, a Mathematician in the Time of *Theodoſius*, mentions in ſome places an *Ariſteus*, whom he calls the Elder, to diſtinguiſh him from another *Ariſteus*, who was likewiſe a Geometrician, but lived after him: *Ariſteus* the Elder had compoſed five Books of *the Solid Places*, that is to ſay, according to the Explanation of *Pappus* himſelf, of the three *Conic Sections*. He could not be later than *Euclide*, whoſe Elements we have, and conſequently he lived about 300 Years before *Jeſus Chriſt*; thoſe five Books are quite loſt.

Monſieur *Viviani* being very well verſed in the Geometry of the Ancients, and regreting the Loſs of agreat number of their Works, undertook, when he was but 24 Years old, to repair it, at leaſt in part, by following, as far as it was poſſible, their Track, and endeavouring to gueſs at what they ſhould have told us. If it be ever permitted to Men to divine, it is upon this occaſion, in which, if one be not ſure to find juſt what one looks for, one is at leaſt ſure of finding nothing to the contrary, and of always meeting with an Equivalent.

Whilſt Monſieur *Viviani* was at work to draw out of his own Stock the five Books of *Ariſteus*, upon the *Solid Places, or Conic Sections*, he was croſſed by a great number of different Affairs, ſuch as Domeſtick Cares, Sickneſſes, and Publick Works, in which he was employed by the Princes of the Houſe of *Medicis*, by whom his Merit was already found out, and alſo rewarded.

He was fifteen Years together without being able to enjoy that Tranquility which is ſo neceſſary for deep Studies; in the mean time, that of *Geometry*, which does not uſe to let People reſt, when ſhe has once taken Poſſeſſion of them, purſued him in the midſt of his various Avocations; and he devoted to her all the Moments he had to breath in, and then conceived the Project of a Work in which he ſhould have occaſion for gueſſing again.

Apollonius Pergæus, ſo called from a City of *Pamphylia*, and who lived about 250 Years before *Jeſus Chriſt*, had collected all that had been writ about *Conic Sections* before his Time by *Ariſteus*, *Eudoxus* of *Cnida*, *Menæchmus*, *Euclides*, *Jonon*, *Thraſidius* and *Nicoteles*, 'twas he who firſt gave the Names of *Parabolon*, *Hyperbolon* and *Ellipſis* to the Three *Conic Sections*, which do not only diſtinguiſh, but deſcribe them too. He had compoſed eight Books, which came down entire to the Time of *Pappus* of *Alexandria*. *Pappus* made a kind of Introduction to that Work; and gave the neceſſary *Lemma's* for the Underſtanding of it. Since then the Four laſt Books of *Apollonius* are loſt.

It appears by the Epiſtle of *Apollonius* to *Eudemus*, and by *Eutocius* the *Aſcalonite*, a younger Author than *Pappus*, that in the Five Books of the *Conics* of *Apollonius*, he treated of the greateſt and the ſmalleſt Right Lines, which we call at preſent, the Queſtions *de Maximis & Minimis*.

Monſieur *Viviani* leaving *Ariſteus* for a while, turned his Thoughts to the reſtoring, after the ſame manner, the Fifth Book of *Apollonius*, and employed himſelf therein during the fifteen Years of his ſeveral Diſtractions.

In the Year 1658, the famous *John Alphonſus Borelli*, Author of the excellent Book, *De Motu Animalium*, paſſing thro' *Florence*, found in the great Duke's Library an Arabick Manuſcript with this Latin Inſcription, *Apollonii Pergæi Conicorum Libri Octo*. He judged by all the external Marks he could diſcover, that this was effectively the Eight entire Books of *Apollonius*; and the Great Duke allowed him to carry the Manuſcript to *Rome*, that it might be tranſlated by *Abraham Ecchaelenſis* the *Maronite*, Profeſſor of the Oriental Languages.

Thereupon Monſieur *Viviani* who was unwilling to loſe the Fruit of what he had collected for his Conjectures upon the Fifth Book of *Apollonius*, took all the neceſſary Meaſures to convince the World, that all that he had done was only Gueſs-work : He procured authentick Teſtimonials that he did not underſtand Arabick, and for greater Proof, that he had never ſeen the Manuſcript : He prevailed with Prince *Leopold*, Brother to the Great Duke *Ferdinand* the Second, to mark with his own Hand his Papers in the Condition they were then in ; nay, he would not ſo much as ſuffer Monſieur *Borelli* to ſend him any Account of what *Ecchaelenſis* might have diſcover'd in tranſlating the Manuſcript ; in fine, he hurried on his Conjectures, and in the Year 1659. publiſhed them under the following Title, *De Maximis & Minimis Geometrica Divinatio in quintum Conicorum Apollonii Pergæi adhuc deſideratum.* This was the firſt Work he publiſhed. In the mean time *Abraham Ecchaelenſis*, who underſtood nothing of *Geometry*, aſſiſted by *Borelli*, a great Mathematician, but who knew as little of Arabick, labour'd in the Tranſlation of the aforeſaid Manuſcript of *Apollonius*. He found that it had been done by an Author named *Abelphath*, who lived at the end of the Tenth Century, and that the whole Eighth Book of it was wanting.

In 1661, *Ecchaelenſis* publiſhed his Tranſlation of the Fifth, Sixth and Seventh Books. Then it was that the Learned compared Monſ. *Viviani*'s Conjectures with the Truth, and it appear'd that he had much more than conjectur'd, that is to ſay, that he had gone a great way farther than *Apollonius* himſelf upon the ſame Matter.

After ſo ſingular and happy an Incident, he was engaged in a Buſineſs of a quite different kind, in which however his Deſtiny put him upon continuing the Works of the Ancients. *Tacitus* relates in the Firſt Book of his Annals, that after the Overflowing of the River *Tiber*, which had done great Damage to *Rome* in the Reign of *Tiberius*, the Senate ſought for Means to prevent the like Inconvenience for the Future; that which moſt naturally occurred, was to turn away the Rivers and Lakes that fell into the *Tiber*. But among all the Rivers the moſt eaſie to be turned was the *Clanis*, now called *La Chianad*; for among the Mountains of *Tuſcany*, there is a great Lake in a long Plain which the *Chiana* runs thro', and where its Waters have ſuch an *Equilibrium*, that they have no more Inclination of deſcending Eaſtwards into the *Tiber* than Weſtward into the *Arno*, which paſſes to *Florence*, ſo that the Waters run both Ways. This River contributes very much to the Inundations both of the *Tiber* and the *Arno*: Wherefore, if it were turned quite into the *Arno*, one of the Cauſes of the *Tiber*'s Inundations might be removed, but it would have been Saving *Rome* at the Expence of *Florence*; inſomuch, that altho' this latter City was in thoſe Days no more than an inconſiderable Colony, yet it made ſuch lively Remonſtrances to the Senate about it, as prevented the Undertaking. The Inhabitants of ſome other Cities of *Italy* threaten'd with the ſame Evil, petition'd likewiſe againſt it, repreſenting the Diminution of the Glory of the *Tiber*, which would thereby have fewer Tributary Rivers, and the Reſpect due to the Bounds formed by Nature, and the Deſtruction of the Religion of ſeveral Nations, who would be deprived of their Gods by being robbed of their Rivers. The *Romans* therefore weighing all theſe Objections, reſolved to leave the Matter as it was; but they did ſince raiſe a great Wall, which ſhut up from one Mountain to the other the Valley thro' which the *Chiana* paſſed to diſcharge it ſelf into the *Tiber*, leaving in the middle of the ſaid Wall an Opening or Sluice to regulate the Quantity of Water they would receive. This Wall is to be ſeen ſtill.

The Diſputes about the Courſe of the *Chiana* were renewed between *Rome* and *Florence* under the Pontificate of *Alexander* the Seventh, and the Pope and Great Duke appointed Commiſſioners to conſider of this Matter; thoſe on the Pope's Side were the Cardinal *Capagna* and Monſieur *Caſſini*, who was to be his Aſſiſtant, the ſame that is now a Member of the *Academy of Sciences*. Thoſe whom the Great Duke named, were the Senator *Michelozzi* and Monſieur *Viviani*; ſo that the *Politicks* had then an indiſpenſable occaſion for the Aſſiſtance of the *Mathematicks*.

In the Years 1664, and 1665, theſe Commiſſioners agreed upon not only what was to be performed on each Side, but alſo the manner of executing it. But as it often happens in Things that concern the Publick only, they went no farther than the bare projecting them.

This Regulation of the Rivers of *Tuſcany* was not a ſufficient Employment for two ſuch Men as Meſſieurs *Caſſini* and *Viviani*, they made at the ſame time ſome Philoſophical Obſervations upon the *Inſects* that are found in the *Galls* and *Knots* of *Oaks*, upon *Shell-Fiſhes* of the *Sea*, which they dug out of the Mountains of that Country, partly petrified, and partly in their natural State; they even extended their Curioſity to the Antiquities, which the Obſervers of Nature being ſufficiently employed otherwiſe, look upon ſometimes with Contempt, as the too uncertain and caſual Effects of the fancy of Men, and they took out of the Earth a great many *Funeral Urns* and *Hetruſcan Inſcriptions*.

But that which was moſt conſiderable was, that in that ſame place Monſieur *Caſſini* ſhewed Monſieur *Viviani* the Eclipſes of the *Sun* in *Jupiter*, cauſed by the *Satellites* or *Moons* of that Planet, and made Tables or Ephemerides of them.

The Diſciple of *Galileo* had the Satisfaction of ſeeing the Progreſs that was made by following the Steps of his Maſter.

About this time ſomething happen'd to Monſieur *Viviani*, which ought to have made him more Proud than any other Incident of his whole Life; for in the Year 1664, the King of *France* ſettled a Penſion upon him, tho' he was not his Subject, nor ſerviceable to that Prince. If theſe Circumſtances exalt the Merit of Monſieur *Viviani*, they do not leſs prove the Magnificence of the King, and his Eſteem for Learned Men. Monſieur *Viviani* thereupon reſolved to Dedicate to the King the Treatiſe he had formerly projected upon the *ſolid Places* of *Ariſteus*, towards which, what he had already done upon *Apolonius*, gave him great Aſſiſtance. To a Man of his Character, the quick Diſpatch of that old Deſign became a Duty. Nevertheleſs, he was unavoidably hinder'd by ſome Publick Works, and even by ſome Negociations, wherewith the Prince, his Maſter, had intruſted him. In 1666, he was honour'd by the Great Duke *Ferdinand* the Second with the Title of Firſt Mathematician to his Highneſs, which was the more Glorious to him, becauſe *Galileo* had worn it before. In 1673, he began to Print his *Ariſteus*; but Publick Works, and Infirmities beſides, croſs'd him again, and made him leave off the Impreſſion.

The following Year produced a new Interruption, from which it was not poſſible for him to defend himſelf: The Memory of the great *Galileo* was concerned, ſome of his Poſthumous Writings having been found, and particularly a *Treatiſe of the Proportions*, to clear the Fifth Book of *Euclide*, who does not ſeem to have explained himſelf intelligibly enough upon that Subject. Monſieur *Viviani* printed it in a ſmall Volume in *Quarto*, under the Title of *Quinto Libro degli Elementi d'Euclide, overo Scienza univerſale delle Proporzioni, Spiegata colla dottrina del Galileo*, 1674. This Work of Geometry is chiefly conſiderable from the Sentiments of his Heart, which every where appear in it. In the Year 1676, there appeared in the Journal of *France* three Problems propoſed by Monſieur *de Comieres*, Provoſt of the Collegiate Church of *Ternant*. The following Year they fell into the Hands of Monſ. *Viviani*.

The two firſt related to the *Triſection* of the *Angle*, a Problem famous among the Ancients, and which gave them a great deal of trouble; Monſieur *Viviani*, who had found out ſome new Methods for this *Triſection*, was tempted to Publiſh them, and give a Solution of the Problems of Monſieur *de Comieres*. Another Inducement to which was a Debt of Friendſhip and Gratitude, which he had a mind to diſcharge to the famous Monſieur *Chapelain*, who had laid great Obligations upon him, and to whom he had formerly promiſed to Dedicate ſome of his Works; ſo that altho' Monſ. *Chapelain* was ſince dead, he did not think himſelf free from his Promiſe. He therefore dedicated to the Memory of his Friend his *Enodatio Problematum univerſis Geometris propoſitorum a Cl. Claudio Comieres*, 1677. He ſays in his Epiſtle Dedicatory, that he chuſes rather to run the Riſque of a Matter new, and odd in appearance, than to be wanting to his Friendſhip and Promiſe; and that inſtead of burying Gifts and Offerings with Monſ. *Chapelain* in his Tomb, he would rather diſperſe them thro' the World, in which his Fame has ſo much reſounded. He reſolves the Three Problems of Monſ. *Comieres* ſeveral ways, raiſing them always to a greater Univerſality, and throughout the whole Book ſhews the Riches and Plenty of Geometry. By the Concern with which he ſpeaks in his Preface of thoſe Problems thus propoſed to the Geometricians, it is eaſie to obſerve that they had turned him out of the way of more important Affairs.

He names ſeveral Illuſtrious Mathematicians that have ſhewn their Diſlike to theſe Enigma's.

Galileo himſelf had adviſed him never to torment himſelf with ſuch things. This is certain, that without making uſe of Mr. *Hudde*'s Reaſons, who ſays that Geometry, whether Daughter or Mother of Truth, was Free and not a Slave, one may ſay with leſs Wit, and perhaps more Truth, that ſuch as propoſe theſe Queſtions have at leaſt the advantage of having turned all their Thoughts that way, and oftentimes the happineſs of expounding the Riddle by chance. But it is likewiſe true, that this reaſon can't be extended to excuſe thoſe that will not apply themſelves to theſe Problems, or at moſt thoſe that cannot reſolve them; but that does not leſſen the Glory of thoſe that ſhall do it.

After the three Problems of Monſieur *de Comieres*, Monſieur *Viviani* reſolved one more, which was then propoſed by an unknown Perſon: But he only did it to fill up the Meaſure, and that he might be in a Condition to declare with greater honour, that he renounced this Trade for ever.

In 1692, he propoſed in the *Acts* of *Leipſick*, a Problem which conſiſted in *finding out the way of making four Windows in a Hemiſpherical Vault, in ſuch manner, that the Remainder of the Vault ſhould be abſolutely ſquareable.* The Problem was ſaid to come *A. D. Pio Liſci puſillo Geometrâ*, which was the Anagram of *Poſtremo Galilei Diſcipulo*, and he ſignified that the Solution thereof was expected from *the ſecret Science of the Illuſtrious Analyſis of the Age*. What he meant by this ſecret Science, was without doubt the Geometry of the *Infinitely Littles, or Differential Calculation*, which was hardly known at that time in *Italy* even by hear-ſay.

The Problem of Monſieur *Viviani* was in effect ſoon diſpatched by this Method. Monſieur *Leibnitz* reſolved it the ſame Day he ſaw it, ond Publiſhed it in the *Acts* of *Leipſick* after an infinite Number of ways, as did likewiſe Monſieur *Bernoulli* of *Baſil.* The Name of the Marquis *de L'Hopital* did not then appear in thoſe Acts, the War hindering him from receiving the Journal; but the Envoy of *Florence* at *Paris* having propoſed the Problem to him, he preſently gave three Solutions of it, and had given many more if he had not found it ſo very eaſie. This ſhews that the Ancient Geometricians, as Learned as they were in that Science, were not deſtined to give much trouble to the Moderns by their Queſtions about the *Differential Calculation.*

This Problem of the *Squareable Vault* was part of a Work that Monſieur *Viviani* publiſhed the ſame Year, 1692, under the Title of *La Struttura & Quadratura eſatta dell' intero, & delle parte d'un nuovo Cielo ammirabile, ed uno degli antichi, delle Volſe regolare degli Architetti*; in which he treats both as a Geometrician and an Architect of the ancient Vaults of the *Romans*, and of a New one that he himſelf had invented, and given it the Name of the *Florentine.* He often reduced Geometry to the uſe of the Arts, and always preferr'd the Uſefulneſs of that Science to the exceſſive Sublimity of it.

He conſider'd every thing as an importunate Diſtraction, that took him off from his *Ariſteus*, which he had devoted to the King, from whom he had received a great many Graces.

In the Year 1699, he receiv'd one, which work'd up his Gratitude to the higheſt Pitch. The King choſe him one of the eight Foreign *Aſſociates* of the *Academy*, according to the Regulation that he had lately made. He was very ſenſible, both by the Dignity and by the ſmall Number of his Collegues, how honourable this Office was to him; wherefore, as he himſelf declares, he reſumed with greater Zeal his *Conjectures upon Ariſteus*. In ſhort, he publiſhed Three Books thereof in the Year 1701. and Dedicated it to the King, by an Inſcription in a *Lapidary* or *Monumental* Stile, in which the *French* have the Pleaſure of ſeeing a Stranger ſpeak like themſelves. This Work is full of the greateſt Enquiries about the *Conics*; and I don't doubt that it would have been as much to his Honour, if *Ariſteus* had been raiſed again by the Diſcovery of his Works, as it was when thoſe of *Apollonius* were found out.

Monſieur *Viviani* could not perſwade himſelf that he had diſcharged the Obligation he lay under to the King, by having Dedicated this Treatiſe to him; Out of the Penſion which his Majeſty allowed him, he built a Houſe at *Florence*, upon a very agreeable Plan, and as Magnificent as was fit for a Private Perſon. This Houſe he called *Ædes Adeodatæ*, and put that Title upon the Frontiſpiece, it being a happy Alluſion to the firſt Name that was given to the King, as well as to the manner by which he had purchaſed the Houſe. An Ingenious Gratitude, and which could not eaſily ſatisfie it ſelf, could have invented nothing more New or more Noble than ſuch a Monument. Monſieur *Viviani*, ſo worthy by his Learning, and by his

Talents, to receive his Majeſty's Favours, became yet more worthy of them, by the Uſe he made after he had received them.

Galileo was not forgot in the Plan of his Houſe: He placed his Buſte, or Upper Part of his Body, upon the Gate, and his Elogium, or rather the whole Hiſtory of his Life, in other Places contrived on purpoſe; and to the End that he might make known to the World a Monument, which of it ſelf was durable enough, he cauſed a Draught of it to be engraven, and put it at the End of his Conjectures upon *Ariſteus.*

The Preface of this Book abounds with his grateful Acknowledgments to ſeveral Perſons, and with the Juſtice which he renders to all the great Geometricians of the Age, and which he pays them, as I may ſay, from the bottom of his Heart. He ſpeaks with great Reſpect and Praiſe of the Abbots *Gradi* and *de Angelis*, of Monſ. *Sluſe*, *Huygens*, *Wallis*, *David Gregory*, and above all of Monſieur *Leibnitz*, whom he calls the Phenix of the Learned Men; and to ſay all in a word, the ſecond *Galileo*; informing us, that his almoſt Divine Diſcoveries have been of great Uſe to the Illuſtrious Marquis *de L'Hopital* his Friend, to Monſieur *Bernoulli*, and ſeveral other Great Men. It is eaſie to judge, that under ſuch Diſpoſitions, tho' he had been brought up in the Ancient Geometry, and lived in a Countty abounding in Wit, he would have received without any Repugnance (if he had lived a little longer) the new Geometry of the North; and it is to be lamented, that theſe Lights, ſo worthy of his Genius, did not reach ſo far as him.

His *Divination, or Conjectures upon Ariſteus*, was the laſt of his Works. He died the 22*d* of *Septemb.* 1703. at the Age of 81 Years, with all the Sentiments of a ſincere Piety.

He had that Innocence and Simplicity of Manners, which are uſually found in thoſe that converſe leſs with Men than Books; but he had none of that Roughneſs and kind of Savage Temper, which commonly reſults from our Converſation with Books only. He was Courteous, Modeſt, a hearty and faithful Friend, and that which includes many Virtues in one, Grateful in the higheſt Degree. It is true, that the general Character of his Nation may rob him of a little of this Glory; for the *Italians* commonly preſerve the Remembrance of good Turns, and to ſpeak plain, of bad ones too, more ſtrongly than other People who are only ſuſceptible of light Impreſſions; but the Gratitude which Monſieur *Viviani* has ſhown upon all Occaſions to his Benefactors has been look'd upon as extraordinary, and attracted the Admiration even of the *Italians*.

The Place of *Foreign Aſſociate*, vacant by his Death, has been fill'd, according to the ordinary Forms, by Monſieur *Martino Poli*, a *Roman*.

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The Life of the Marquis de L'HOPITAL.

William Francis de L' Hopital, Chevalier, Marquis *de St. Meſme*, was born in 1661, of *Anne de L' Hopital*, Lieutenant-General of the King's Armies, Maſter of the Horſe to his late Royal Highneſs *Gaſton* Duke of *Orleans*, and of *Elizabeth Gobelin*, Daughter of *Claude Gobelin*, Intendant of the King's Armies, and Counſellor of State in Ordinary.

The Houſe of *L'Hopital* conſiſted of two Branches; the Eldeſt, from which proceeded the Marquis, has join'd to the Name of *L' Hopital* that of St. *Meſme*; and the Youngeſt, which is now extinct, has produc'd two Marſhals of *France*, and the Dukes of *Vitry*, both of 'em came from the common Stock of *Adrian de L' Hopital*, Lord-Chamberlain to King *Charles* the VIIIth, Captain of the Hundred *Swiſſes*, and Lieutenant-General in *Britany*; he commanded the Van-Guard of that Prince's Army, at the Battel of St. *Aubin*, in 1488.

When our Marquis was but a Child he was under the Care of a Preceptor, who at idle Hours apply'd himſelf to the Study of the Mathematicks. The young Scholar, who had very little Diſpoſition, as it appear'd, for learning *Latin*, had ſcarce ſeen ſome of the Figures of Circles and Triangles in the Elements of Geometry, but the natural Inclination, which is always the Index of great

Talents, preſently declar'd it ſelf: He ſet himſelf to Study with Paſſion, that which at the firſt ſight would have frighten'd any Body but him. He had afterwards another Preceptor, who was forc'd by his Example to apply himſelf to Geometry; but tho' he was a Man of Senſe and Application, his young Pupil always left him at a great Diſtance behind: What we attain by Labour only, does not come near to the voluntary Favours of Nature.

One Day, the Marquis *de L'Hopital*, when he was but fifteen Years old, happen'd to be at the Houſe of the Duke of *Roannez*, where ſome able Geometricians, and among the reſt Monſieur *Arnaud* was ſpeaking of a Problem of Monſieur *Paſchal* upon the *Cycloid*, which ſeem'd to be very difficult; the young Mathematician ſaid, he did not deſpair of reſolving it. They could hardly forgive ſuch Preſumption and Forwardneſs even in one of his Age; however, a few Days after he ſent him the Solution of the Problem.

He enter'd into the Army, but without renouncing his deareſt Paſſion, for he could not forbear ſtudying Geometry even in his Tent; and he did not only retire to Study, but likewiſe to conceal his Application to it. For it muſt be confeſs'd, that the *French* Nation, tho' as polite as any whatever, ſtill labours under that Kind of Barbarity, as to doubt whether Learning carry'd to a certain Degree, does not derogate from a Man's Gentility, and whether it becomes a Man of Quality to know any thing of Letters. He was ſo great a Maſter of the Art of hiding his Knowledge, and of ſeeming ignorant for Faſhion-ſake, that as long as he was in the Trade of War, thoſe that look moſt narrowly into their Neighbours Faults, never ſo much as ſuſpected him of being a great Geometrician; and I my ſelf have ſeen ſome of thoſe that were in the Service at the ſame Time, very much ſurpriz'd to hear, that a Man who had liv'd among them, and like them, was found to be one of the greateſt Mathematicians of *Europe.*

He was Captain of Horſe in the Regiment call'd the Colonel-General's; but the Weakneſs of his Sight, which was ſo ſhort, that he could not ſee ten Steps before him, occaſioning in the Service perpetual Inconveniencies, which he had long, but in vain endeavour'd to ſurmount, he was at laſt oblig'd to yield, and to abandon a Poſſeſſion in which he might have equall'd any of his Anceſtors.

Aſſoon as the War had no longer any Share in him, the Mathematicks engroſs'd him wholly. He judg'd by the Book of *The Search after Truth*, that it's Author ought to be an excellent Guide in the Sciences; he therefore conſulted him, and made a good Uſe of his Advice, and contracted a Friendſhip with him, that laſted 'till Death. His Knowledge ſoon arriv'd to ſuch a Point, as that he could no longer conceal it: He was but 32 Years old, when Problems drawn from the moſt ſublime Geometry, affectedly choſen for their Difficulty, and propoſed to all the Geometricians in the Tranſactions of *Leipſick*, raviſh'd his Secret from him, and forc'd him to confeſs to the Publick that he was capable of ſolving them.

The firſt of theſe Problems was the following, propoſed in 1693, by Monſieur *Bernoulli*, Profeſſor of Mathematicks at *Groninguen*; *To find a Curve, ſuch as all its Tangents terminated at the Axis, may always bear a Proportion with the Parts of the ſaid Axis, intercepted between the Curve and theſe Tangents.* It was ſolv'd by none but Mr. *Leibnitz* in *Germany*, Mr. *Bernoulli* in *Swiſſerland*, Brother to him that propoſed it; Monſ. *Huygins* in *Holland*, and the Marquis *de L' Hopital* in *France*. Monſieur *Huygens* confeſſes in the Tranſactions, that the Difficulty of the Problem made him reſolve at firſt not to trouble his Head about it, but that ſo new a Queſtion had broke his Reſt in Spite of him, had perſecuted him without Intermiſſion, and that finally he was not able to reſiſt it.

One may eaſily judge of what a Nature, in the Matter of Geometry, was a Queſtion that appear'd ſo difficult to Monſ. *Huygens*.

All that know the News of Learning, have heard ſpeak of the famous Problem of the *Swifteſt Deſcent*. Mr. *Bernoulli* of *Groninguen*, upon that Occaſion, propoſed the following Problem in the Tranſactions of *Leipſick*: *Suppoſe a heavy Body falling obliquely to the Horizon, what ſort of a Curve Line muſt it deſcribe to fall as quick as poſſible?* For, as it has been already related in the Hiſtory of the Academy of Sciences for the Year 1699, this ſurprizing Paradox was demonſtrated, *viz.* That a Streight Line, tho' the ſhorteſt of all Lines, that can be drawn between two Points given, was not, however, the Way that ſuch a

Body would take to deſcend in the ſmalleſt Space of Time. It was beſides certain, that the Curve in Queſtion was not a Circle, as *Galileo* believ'd it, and the Miſtake of ſo great a Man may ſerve to make one ſenſible of the Difficulty of the Queſtion. Monſieur *Bernoulli* propoſed this Problem in the Month of *June*, 1696, and allow'd all the Mathematicians of *Europe* all the remaining part of the Year to think of it. He found that thoſe ſix Months were not ſufficient, and therefore he granted them the four firſt of the following Year; in thoſe ten Months there appear'd but four Solutions of it, *viz.* From Mr. *Newton*, Mr. *Leibnitz*, Mr. *Bernoulli* of *Baſil*, and the Marquis *de L'Hopital*, ſo that *England*, *Germany*, *Swiſſerland*, and *France*, did each of them furniſh one Geometrician for the aforeſaid Problem.

The ſame Names may be met with again at the Head of ſome like Solutions in the Acts of *Leipſick*, and thoſe Gentlemen ſeem to be in Poſſeſſion of the moſt uncommon and ſublime Knowledges.

In the Hiſtory of the Academy for the Year 1700, there is an Account of another Problem propoſed, as almoſt all the reſt were, by Monſ. *Bernoulli* of *Groninguen*, but reſolv'd only by the Marquis *de L'Hopital.* The Queſtion was, *To find in a Vertical Plain, a Curve, ſuch as the Body that deſcrib'd it, deſcending freely, and by its own Weight, ſhould always preſs in each of its Points, with a Force equal to its abſolute Weight?* The ſeveral Difficulties, that is to ſay, the Beauties of this Problem, are there repreſented:

The Modern Geometricians are not eaſy to be ſatisfy'd; and that which made *Archimedes* run out of the Bath along the Streets of *Syracuſa*, crying, *I have found it*, would not be eſteem'd by them ſuch a glorious Diſcovery.

The Hiſtory of the Academy for the Year 1699, makes mention of another Solution, to which few beſides the Marquis *de L'Hopital* could attain. Mr. *Newton*, in his excellent Book of the *Mathematical Principles of Natural Philoſophy*, has given the *Figure of a ſolid Body which might cleave the Water, or any other Liquid, with the leaſt Difficulty that was poſſible.* But he has not ſhewn us by what Art or Method he arriv'd to the Determination of that Figure. His Secret ſeem'd to him worthy to be conceal'd from the Publick. Monſ. *Fatio*, a famous Geometrician, undertook to diſcover it, and ſent the Analyſis of it printed to the Marquis *de L'Hopital*; it contain'd five large Pages in Quarto, almoſt wholly taken up in the Calculation. The Marquis frighten'd with the Tediousneſs of it, was of Opinion, that he could as ſoon find out the Solution as read it; and he did effectually find one in two Days time, which was very ſimple and natural, and this was one of his chiefeſt Talents, for he did not only overtake Truth, tho' never ſo myſterious, but he always came at it by the ſhorteſt Way. It is a Kind of Fatality, that in all Arts the Methods, or the moſt natural Idea's, are not thoſe that offer themſelves the moſt naturally: One does almoſt always put one's ſef to too great Expence for the Diſcovery of thoſe Things which one has undertaken, and there are few of thoſe happily frugal Genius's that don't ſpend more than is abſolutely neceſſary thereto. It is true, Riches and Plenty are neceſſary to furniſh our uſeleſs Expences; but he that avoids them is more Wiſe, and more truly Rich alſo.

It would be too long to account here for all the Maſter-pieces in Geometry, with which the Marquis *de L'Hopital* and the ſmall Number of his Equals have adorn'd the Journals of *Germany* and *France.* One would ſuſpect, without doubt, that to enter into thoſe Queſtions which were reſerv'd for them, they ought to have, beſides their natural Genius, ſome ſpecial Key, which was in no other Hands beſides. They had one indeed, and that was the Geometry of *Infinitely Littles*, or *Differential Calculation*, found out at the ſame Time by Meſſieurs *Leibnitz* and *Newton*, and afterwards brought to Perfection by themſelves, and the Meſſieurs *Bernoulli* and *de L' Hopital.*

The Illuſtrious Monſ. *Huygens*, who was not the Inventer of the *Differential Calculation*, as Meſſieurs *Newton* and *Leibnitz*, nor had made uſe of it in all his Geometrical Studies, as Meſſieurs *de L'Hopital* and *Bernoulli*; and yet who, without the Aſſiſtance of it, had attain'd to the moſt exalted Theories, and had rais'd himſelf one of the higheſt Reputations; and ſo, like other Men, and perhaps with much more Reaſon, might have deſpiſed what he had not known, and treated as unprofitable that which had not been neceſſary to him in his great Works, was nevertheleſs of Opinion, both from the Merit of thoſe who made uſe of this Method, and from the Miracles he ſaw produced by it; that it was worthy of his Application: He had been ſo great a Man as to acknowledge that he could ſtill learn ſomething in Geometry, and without ſcruple condeſcended to addreſs himſelf to the Marquis *de L'Hopital*, who was but little above half his Age, to be informed of the *Differential Calculation*; and doubtleſs this Circumſtance of the Marquis's Life is much more *Glorious* to Mr. *Huygens* than to him.

Not but Mr. *Huygens* did know already by his own Experience ſomething of the Doctrine of the *Infinite*, to which one is guided every Moment by the *Differential Calculation*; for he had been obliged to penetrate even ſo far in ſome of his niceſt Enquiries, eſpecially in that which he made for the Immortal Invention of the *Pendulum*: For the moſt Subtil Geometry cannot go far without entring into the *Infinite*: But there is a vaſt Difference between a General Knowledge of the Map of any Country, and the being able to find out all the Ways of it, and even thoſe little Paths, which often ſave ſo much Pains to Travellers.

Monſ. *Huygens* was then in *Holland*, whither he retired after he had left *Paris*, and the Academy of Sciences, of which he was one of the chiefeſt Ornaments. It appears by a great many of his Letters, found among the Papers of the Marquis *de L'Hopital*, and eſpecially by thoſe of the Years 1692, and 1693. that he communicated to Monſ. *L'Hopital* his Difficulties upon the *Differential Calculation*, and that when any thing ſtop'd him, he did not impute it to the Method, but to his not being ſufficiently Maſter of it, and ſaid, that *he ſaw with Surprize and Admiration the Extent and Fertility of this Art, that on which ſide ſoever he turned himſelf, he diſcovered new Uſes of it; and finally,* (theſe are his own words) *he conceived in it a Progreſs, and an Infinite Speculation.* He did even publickly declare in the Acts of *Leipſick*, that without a *Differential Equation* he could never have arrived at the Diſcovery of a Curve, of which the Tangents and the Parts of the Axis always bear a Proportion to each other: And he adds in the ſame Acts, *That we muſt obſerve in this Problem, a new and ſingular Analyſis, opening the way to a great many things upon the Theory of the Tangents, as has been extremely well obſerved by the illuſtrious Inventor of a Calculation, without which we ſhould have found it very difficult to have penetrated ſo deeply into Geometry.* He writ at the ſame time to the Marquis *de L'Hopital*, that he was beholden to his Inſtructions for this *Differential Equation*, by the help of which he had attained to the Solution of the Problem.

'Till this time the Geometry of the *Infinitely Littles* was only a kind of Myſtery, and as one may ſay, a Cabaliſtical Science, monopolized by five or ſix Perſons. Oftentimes the Solutions were publiſhed in the Journals, without mentioning the Method of coming at them, and even when that was diſcover'd, it was no more than ſome Rays of the Science that broke out, but were quickly overcaſt. Again, the Publick, or to ſpeak more properly, the ſmall Number of thoſe who aſpired to the Sublime Geometry, were ſtruck with an unprofitable

table Admiration, but not enlighten'd by it, and our Artiſts found the Means of attracting their Applauſes, and at the ſame time of with-holding the Inſtruction wherewith they ought to have paidthem.

Monſieur *de L'Hopital* was reſolved to diſcloſe, without Reſerve, theſe hidden Treaſures of the New Geometry, which he did in his famous Book *of the Analyſis of the Infinitely Littles*, publiſhed in 1696. there were laid open all the Secrets of the Geometrical Infinite, and of the Infinite of Infinites; in a word, of all thoſe different Orders of Infinites, which raiſe themſelves one above the other, and form an Edifice the moſt amazing and the boldeſt that Human Mind durſt ever have projected.

As there are Determinate Relations between the Finite Greatneſſes, which are the ſole Object of Mathematical Enquiries, and the Greatneſſes of theſe different Orders of Infinites; we come by the way of the Infinite to the Knowledge of the Finite, to which no other Method could ever attain that had not the Boldneſs and the Art at the ſame time of handling the Infinite. The Book of the Infinite Littles was therefore all over ſhining with the unknown Truths of the Ancient Geometry, and Truths that were not only unknown, but alſo unacceſſible to that kind of Geometry. The ancient Truths were as it were loſt there in the Crowd of the new ones, and the Facility with which they were diſcover'd made Men regret the Pains they had formerly coſt the firſt Inventers; Demonſtrations, which by other Methods would have required a vaſt Compaſs, ſuppoſing that it had been poſſible to attain to them, or which even in the hands of another Geometrician inſtructed in the ſame Method would have ſtill been tedious and embaraſſing, were of ſuch a plainneſs and ſhortneſs, as render'd them almoſt ſuſpected.

Such is the Effect of General Methods when one has been able to find them out once. One is at the Fountain-head, and one has nothing more to do, but to let one ſelf be carried down the gentle Stream of the Conſequences. One ſingle Rule of Monſieur *de L'Hopital*'s Book gives the *Tangents* of all the *Curves* imaginable; another, the Application of all the Greateſt or Smalleſt, or all the Points of *Inflexion* and of *Return*, or of all the *Evolutes*, or of all the *Catoptrick* or all the *Dioptrick Curves*. Entire Treatiſes made by great Authors are reduced ſometimes to ſome Corollaries, which one meets in the way, and which one hardly diſtinguiſhes in the Crowd; the whole relates to kinds of Syſtems which Monſ. *de L'Hopital* has begun to bring into Geometry, and which will place that Science in a new Light.

There are, eſpecially upon the Mathematicks, more good Books, than Books well writ; that is to ſay, there are enough that may Inſtruct, but few that do it with a certain Method, and as one may ſay, with a certain Agreeableneſs; 'tis well enough if we have a good Matter in our hands, the Form is too much neglected: But Monſieur *L'Hopital*'s Book was as well compoſed as good in it ſelf, having found out the Art of Reducing an infinite Number of things into a ſmall Space, and with that Brevity and Exactneſs, that are ſo delicious to the Mind; the Order and Regularity of his Idea's have almoſt render'd the uſe of Words unneceſſary; His deſign is only to make you think, being more careful to excite the Enquiries of other People, than ambitious of diſplaying his own Diſcoveries.

Accordingly that Work has been received with an univerſal Applauſe; for one may juſtly call it univerſal, when one can ſo eaſily reckon up throughout all *Europe* the Votes of thoſe that have given a Negative to it, and there will always be ſome Negatives put upon New and Original things, eſpecially when they are required to be well underſtood. Thoſe who obſerve the Events of the Hiſtory of Sciences know with what Greedineſs the *Analyſis of the Infinitely Littles* has been laid hold on by all the Geometricians of this preſent Age, to whom the old and the new Methods are both indifferent, and who have no other Intereſt than that of chuſing the beſt Path. As the Deſign of the Author was principally to raiſe Mathematicians, and to ſow the Seeds of the High Geometry in the Minds of Men, he has had the Pleaſure of ſeeing the daily Fruits thereof, and of obſerving that Problems, the Solution of which were formerly reſerved only for ſuch as were grown old among the Thorns of the Mathematicks, were now become the firſt Eſſays of Young People. This Revolution will probably grow greater and greater, and he in time would have had as many Diſciples as there were Mathematicians in the World.

After having ſeen the Uſefulneſs of his Book about the *Infinitely Littles*, he engaged in another Labour, no leſs proper to make Geometricians.

This Deſign of his compriz'd the *Conick Sections*, the *Geometrical Places*, the *Conſtruction of the Equations*, and *a Theory of the Mechanick Curves*. This was properly the Plan of Monſieur *Deſcartes*'s Geometry, but more dilated, and more complete. He did not pretend that this Work was to be as New or as Sublime as the firſt; He might have turned his Enquiries towards *the Integral Calculation* which follows, and ſuppoſes the *Differential*, but is attended with much greater, and as yet unſurmountable Difficulties, and thereby at preſent employs the moſt Learned Geometricians, and is become the Object of their Ambition; but he preferr'd a Buſineſs that was to be more beneficial and neceſſary to the Publick, and his Zeal for Geometry got the better of the Concern for his own Glory. However I am a Witneſs, that he could not forbear regreting the *Integral Calculation*.

This Work was almoſt finiſhed when he was ſeized in the beginning of the Year 1704. with a Fever, that at firſt appeared by no means dangerous; but when it was found to reſiſt all the different Remedies made uſe of by the Phyſicians, his Friends began to fear for him, nor did the Patient ſtay for any greater Danger to put him in Mind of his Death, but prepared himſelf for it in a moſt edifying manner; ſoon after which he fell into an Apoplexy that put an end to his Life the Day after it took him, being the 2*d* of *February*, and the 43*d* Year of his Life.

Some have attributed his Death to his exceſſive Labours in the Mathematicks, and that which may confirm it is a Circumſtance I have learnt from himſelf, *viz.* That many Mornings which he had devoted to that Study, often became whole Days before he was aware of it.

He had a mind to have quitted it, out of care for his Health, but he never could abſtain for above four Days at a time; beſides one may eaſily believe that he muſt have made vaſt Efforts of Mind, when one conſiders how far he was come at the Age of 43 Years, and how much time in ſo ſhort a Life he had ſquander'd away out of Love to the Mathematicks. He had been in the Service; he was of that Quality which engaged him to a great Number of Devoirs; he had a Family and the Conſequence of it, Domeſtick Cares, a good Eſtate of his own to manage, which always brings Buſineſs with it; beſides which, he lived in the World, and with it, in a manner like thoſe whoſe idle Employments are their ſole Buſineſs; nor was he an Enemy to Pleaſures; theſe were Avocations enough in Conſcience; and let his Talents have been never ſo proper for the Mathematicks, it was impoſſible but that his want of Time muſt be ſupplied with a prodigious Application; however it did not appear that his Studies affected his Health, he had the Appearances of the beſt and ſtrongeſt Conſtitution as could be deſired. He was by no means Melancholly or Penſive, on the contrary rather inclinable to Mirth; ſo that his great Mathematical Genius did not ſeem to have coſt him any thing.

In his moſt ordinary Diſcourſes one perceived the Juſtneſs, Solidity, and in a word, the Geometry of his Soul; he was of an eaſie Converſation, and of a perfect Honeſty, open and ſincere,

cere, conſenting to what he was, becauſe he was ſo, but making no Advantage of it, the true Modeſty of a great Man, ready to own his Ignorance, and to receive Inſtructions even in matters of Geometry, if it were poſſible to be inſtructed therein; by no means Jealous, not for want of knowing his own Superiority, but out of a natural Equity; for without that, thoſe that believe themſelves, and even thoſe that are Superiour to others, are notwithſtanding jealous of others.

He married *Marie Charlotte de Romilley de la Cheſnelaye*, a Lady of an Ancient and Noble Family in *Britany*, and who brought him a great Eſtate. There was ſuch a Harmony and Union between them, that he inſpired her with his Genius for the Mathematicks. He left by her one Son and three Daughters.

His Place of *Honorary Academiſt* was filled by the Marquis of *Daugeau*, Governour of *Touraine*, Counſellor of State in Ordinary, and Grand Maſter of the Royal and Military Orders *de Nôſtre-Dame du Mont Carmel*, and of St. *Lazare de Jeruſalem*, &c. and one of the Forty Members of the *French Academy*.

The LIFE *of Monſieur* BERNOULLI.

JAmes *Bernoulli* was Born at *Baſil* the 27. *December*, 1654. He was Son of *Nicholas Bernoulli*, who is yet living, and has conſiderable Employments in that Canton. One of the Brothers of the Gentleman whoſe Life we are writing is in a yet higher Station than his Father.

Monſieur *Bernoulli* was Educated after the uſual manner of his Time; He was deſigned for a Miniſter, and accordingly inſtructed in *Latin*, *Greek*, and the Philoſophy of the Schools, but nothing of Geometry; however, having ſeen by chance ſome Geometrical Figures, he was ſtruck with thoſe Charms of which few Men in the World are ſenſible. He had hardly any one Book of the Mathematicks, nor durſt he make uſe of thoſe he had but by ſtealth, ſo that you may be ſure he had no Maſter, but his Inclination joined with a great Capacity became his Preceptor. He likewiſe apply'd himſelf even to Aſtronomy; and as his Father, who had other Views for him, always oppoſed thoſe Studies, he expreſſed his Circumſtances by a Device repreſenting *Phaëton*, guiding the Chariot of the Sun, with a Latin Inſcription, which ſignified, *I am among the Stars in ſpight of my Father*.

He was but 18 Years old, and could hardly otherwiſe be counted a Mathematician than by his violent Propenſity for the Mathematicks, when he gave the Reſolution of that Chronological Problem, difficult enough to one of his Age, by which the Years of the Solar Cycle, of the Golden Number, and of the Indiction being given, the Year of the *Julian* Period was to be found.

At the Age of 22 Years he went to Travel; being at *Geneva*, he taught a young Woman to Write who had loſt her Eyes within two Months after ſhe was Born, and invented a new Method for that purpoſe, having diſcovered both by Reaſon and Experience the Inefficacy of that which *Cardan* propoſes. At *Bourdeaux* he compoſed univerſal *Gnomonick*-Tables, which are now ready for the Preſs. After having ſeen *France*, he returned to his own Country in the Year 1680. there he began to Study the Philoſophy of *Deſcartes*. That Excellent Book did more enlighten than convince him, and he drew from that great Author ſtrength enough to engage even with him afterwards.

At the end of the Year 1680, there luckily appeared a Phenomenon fit to exerciſe a young Philoſopher; it was a Comet which has occaſion'd ſeveral famous Works, and among the reſt the Firſt that Mr. *Bernoulli* ever publiſhed, and which he called *Conamen Novi Syſtematis Cometarum, pro motu eorum ſub calculum revocando, & apparitionibus prædicendis.* He ſuppoſes that the *Comets* are *Satellites*, or *Moons*, of the ſame Planet, raiſed ſo high above *Saturn*, tho' placed in the Vortex of the Sun, that it is always inviſible to our Eyes; and that thoſe Moons are not viſible neither, but when they are in the loweſt Part of their Circle, and in the neareſt Poſition to us. From thence he concludes that

Comets are everlaſting Bodies, and that their Return may be foretold, which is alſo the Opinion of Monſieur *Caſſini*. According to the Syſtem and Calculations of Monſieur *Bernoulli*, the Comet of 1680, will appear again upon the 17th of *May* 1719, in 1 Degr. 12 Min. of *Libra*. This is a Prediction bold enough, conſidering the Exactneſs of the Circumſtances.

Here I cannot forbear relating an Objection which was propoſed to him very ſeriouſly, and which he condeſcended to anſwer in as grave a manner: It was, that if Comets are regular and ordinary Stars, they can no longer be eſteem'd extraordinary Tokens of the Wrath of Heaven. He attempts ſeveral Ways of ſolving it, and at laſt comes off in this manner: He aſſerts, That the Head of the Comet being eternal, cannot be aſſign'd, but the Tail may, becauſe according to him, this laſt is only accidental. Such Meaſures were the learned Men about 25 Years ago oblig'd to keep with popular Opinions. At preſent we have got over it; that is to ſay, the greateſt Part of the World are cured of their Whims about Comets, and the Fruits of ſound Philoſophy ſpread themſelves farther and farther: It would be a good thing, if it were practicable, to note the Epoca of the End of thoſe Errors which ſhe has deſtroy'd.

In the Year 1682, Monſieur *Bernoulli* publiſhed his Deſertation *De gravitate Ætheris*; he does not only treat therein of the Weight of the Air, ſo inconteſtable and ſo ſenſible by the means of the Barometer, but chiefly about that of the *Æther*, a Matter much more fine and ſubtile than the Air we breath. It is to the Weight and Preſſure of that Matter that he refers the Hardneſs of Bodies. In his Preface he proteſts, that when he had form'd this Syſtem, he did not remember that he had ever met with it in that famous Book, call'd *The Search after Truth*, and applauds himſelf for having fallen upon the ſame Opinion with Father *Malbranche*; and, what is more remarkable, that he had attain'd to it by the ſame Methods.

As the Alliance between Geometry and Natural Philoſophy produces the chiefeſt Uſefulneſs of the former, and all the Solidity of the latter, he ſet up Societies, and a kind of an Academy, in which he made thoſe Experiments that were the Foundation or the Proof of the Geometrical Calculations, and he was the firſt Man that eſtabliſh'd in the City of *Baſil* this Way of Philoſophiſing, the only reaſonable one, and which nevertheleſs has been ſo long in appearing.

He had already penetrated into the moſt abſtruſe Parts of Geometry; and as he ſtudy'd it, he render'd that Science more perfect by the Diſcoveries he made in it; when in the Year 1684, the Face of Geometry was almoſt chang'd at once. The illuſtrious Monſieur *Leibnitz* publiſh'd in the Tranſactions of *Leipſic*, ſome Eſſays of his new Differential Calculation, or as he ſtiles it, *Infinite Parva*, of which he conceal'd both the Art and Method. As ſoon as Meſſieurs *Bernoulli* (for the younger Brother, a famous Geometrician, has an equal ſhare in the Glory of it) perceiv'd by the little they could ſee of this Calculation, how great the Extent and Glory of it would be, they obſtinately ſet themſelves to diſcover the Secret, and to carry it away from him that had invented it; in which they ſucceeded and perfected the Method to ſuch a Degree, that Monſieur *Leibnitz*, out of a Sincerity worthy of a Great Man, declar'd, That it belong'd to them as much as to him. Thus it is, that the leaſt Ray of Truth breaking thro' a Cloud ſufficiently enlightens Great Minds, whilſt the naked Truth can hardly make any Impreſſion upon others.

Monſieur *Bernoulli*'s Country did Juſtice to a Citizen who had been ſo great an Honour to it, for in the Year 1687, he was choſen, by a unanimous Conſent, Profeſſor of Mathematicks in the Univerſity of *Baſil*: It was then he had an Opportunity to exert a new Talent, which was that of Teaching; for a Man has been capable of attaining to the higheſt Pitch of Learning, and yet unable to lead others up to it, and ſometimes it coſts the Mind more Pains to deſcend again, than to continue ſoaring. Monſieur *Bernoulli*, by the great Eaſineſs and Nicety of his Leſſons, and by the great Progreſs his Pupils made in a very ſmall time, attracted a Number of Strangers to *Baſil* to hear his Lectures. The Exerciſes which his Office of Profeſſor requir'd of him, produc'd, among other Fruits, all that he has publiſh'd upon the Infinite Series or Ranks of Numbers. The Queſtion is, To find the Amount of a Sum of an Infinity of Numbers, regulated according to ſome Order or Law? and without doubt, Geometry would never ſhew greater Boldneſs than when ſhe pretends to make her ſelf Miſtreſs of Infinity it ſelf, and to treat it as ſomething Finite; thereby we diſcover the Rectifications or Quadratures of Curves; for all Curves may paſs for Infinite Continuations of Right Lines Infinitely little, and the Spaces which they compriſe, for an Infinity of Spaces infinitely little, all terminated by Right Lines. One while we find that theſe Sequels or Continuations which comprehend an Infinity of Terms, are nevertheleſs but equal to a certain Finite Term, and then the Curves which they repreſent are either Rectifiable or Squarable; ſometimes we find that theſe Sequels are loſt in their Infinity, and are abſolutely out of the Reach of any Calculation; in which Caſe the Length of the Curves, or their Spaces, do likewiſe eſcape our Enquiries. *Archimedes* ſeems to have been the firſt that found the Sum of a Geometrical Progreſſion infinitely decreaſing, and thereby moſt ingeniouſly diſcover'd the ſquaring of the Parabola. Dr. *Wallis*, the famous *Engliſh* Mathematician, upon theſe Sequels compoſed his *Arithmetick of Infinites*, and Meſſieurs *Leibnitz*, and *Bernoulli* have carry'd this Theory much farther ſince his Time.

But the Object of Monſieur *Bernoulli*'s moſt conſtant Pains was the Calculation of the Infinitely Littles, and the Enquiries where it was neceſſary. He, and the ſmall Number of his Equals, had found out, as it were, a New World, unknown 'till then, and of a difficult and even dangerons Acceſs, but which recompenc'd their Labour with immenſe Riches, and which were not to be met with in the Old World.

Having already given an Account of the late Marquis *de L'Hopital*, I have in ſome manner deſcrib'd Monſieur *Bernoulli*, becauſe they have often given by that Method, which was common to them both, a Solution of the ſame Problems, which they could have laid hold on no other Way. We will not therefore repeat what has been there ſaid, but only add ſome of Monſieur *Bernoulli*'s particular Diſcoveries.

The Differential Calculation being laid down, every one knows how neceſſary the Integral Calculation is; this being, as one may call it, the Reverſe of the other; for as the Differential Calculation deſcends from Finite Greatneſs to their Infinitely Littles, ſo the Integral Calculation does aſcend from Infinitely Littles to Finite Greatneſs; but the Aſcent is painful, and in ſome Caſes as yet impoſſible.

In the Year 1691, Monſieur *Bernoulli* publiſh'd two Eſſays upon the Integral Calculation, and they were the firſt that have hitherto appear'd, by which he open'd a new Way to the Geometricians. Theſe two Eſſays related to the Rectification and Quadrature of the two different kinds of Spirals; one is form'd by the Extremities of the Ordinates of an ordinary Parabola, of which the Axis is rolled up in a Circle; the other is the Logarithmical Spiral, which always makes the ſame Angle with its Ordinates, concurring in its Center. And as the Curve, which is call'd *Loxodromical*, deſcrib'd by a Veſſel which always follows the ſame *Rhomb* of the Wind, does likewiſe always make the ſame Angle with all the *Meridians*, it follows, that if the Meridians were

Right Lines, concurring to the Pole, the Loxodromical would become the Logarithmical Spiral; from whence Monſieur *Bernoulli* took Occaſion to paſs from the Logarithmical to the Loxodromical Spiral, and diſcover'd a great many new things, and very curious with reſpect to the Longitudes and Navigation.

About this Time the Problem of the *Linea Catenaria*, propoſed by him, made a great Noiſe among the chiefeſt Geometricians. It is the Curvity made by a Chain faſten'd at each End, equally heavy in all its Parts, each of which Part is drawn down by its own Weight, and at the ſame Time ſtopp'd by the Points. After that Meſſieurs *Leibnitz*, *Huygens* and *Bernoulli* his Brother had reſolv'd the Problem, and determin'd this Curvity, he prov'd in the Year 1692, that it was the ſame with a Sail ſwell'd by the Wind: And as he then began his Enquiries and Diſcoveries upon the Curvity, which a Spring would make upon one of its Extremities faſten'd upon a Plain, and the other carry a Weight, he ſhew'd, that the ſame Sail, which being ſwell'd with a Horizontal Wind, would be bent into the *Catenaria*, were ſwell'd with a liquid Matter that ſhould gravitate upon it Vertically, it would be bent like a Spring, or *Elaſtically*, for that's the Name he gives to this ſort of Curve. Theſe Determinations are not the ſimple Sports of Geometry, and only to be eſteem'd for the Difficulty of their Solution, but they likewiſe occur in the niceſt Diſputes of Phyſicks or Mechanicks, when the Queſtion is to diſcover with great Exactneſs the Action of *Liquids* or of *Weights*?

To forbear entering into a longer detail of Monſ. *Bernoulli*'s Geometrical Enquiries, it ſhall ſuffice to give you here a Sketch of his Theory of the Curves that ſlip or move upon themſelves. Whatever Curve is propoſed, he conſiders it as immoveable, and at the ſame time he ſuppoſes that another Curve equal and like, that is to ſay of the ſame Kind, ſlips upon it and applies all its Points to the Curve that is under it, one after the other: Joyning to this Conſideration that of the Evolute, which would have produced the propoſed Curve, he draws from the ſliding of this Curve upon it ſelf not only a *Roulette* or *Cycloid*, deſcribed after the ordinary manner by a fixed Point of the moveable Curve, but likewiſe the *Cauſtick* by *Reflexion*, and beſides two Curves, the firſt of which he calls the *Anti-Evolute*, and the ſecond the *Pericauſtick*; and to carry himſelf through this Labyrinth of different Laws, and to enable him to determine the Nature of them, it is only neceſſary to know the firſt, which is the Spring of all the reſt.

By this means he attains to a wonderful Propriety of the Logarithmical Spiral, which is, that all the Curves, which either produce it, or are produced by it, after the manner we have explained them, its *Evolute*, *Cauſtick*, *Cycloidal Anti-Evolute* and *Pericauſtick* are other Logarithmical Spirals, equal and like in all things to that from which they are generated. It is eaſie to judge that ſuch like Reſolutions require a great Apparatus of Geometry, and muſt needs be the utmoſt Efforts of a Mathematical Genius.

Theſe Rollings of the Curves guided Monſ. *Bernoulli* to the Diſcovery of the two general Formules of the *Cauſticks* by *Reflexion* and *Refraction*, which compriſe two Sections of the Marquis *de L'Hopital*'s Book, or rather the whole Art of *Catoptricks* : But Monſieur *Bernoulli* ſuppreſſed the Analyſis of the Formules, and Monſieur *de L'Hopital* has revealed the Myſtery thereof.

All theſe Enquiries, and a great Number of others as profound as theſe, which we muſt paſs over in Silence, have been performed by the Calculation of the Infinitely Littles; and was it poſſible to prove its Excellency better, and at the ſame time to teach the Art of handling it? And ſo likewiſe this Method is become that of all the great Geometricians without Exception; and tho' it is ſometimes a little crabbed and thorny, it is much more eaſie to learn the Practice of it, than to advance further without its help.

When the Royal Academy of Sciences had received from the King in the Year 1699. that Eſtabliſhment by which they were allowed to chuſe eight Foreign Aſſociates, all the Votes immediately fell upon the two *Bernoulli*'s in that ſmall Number. The *Elector* of *Brandenbourg* having likewiſe eſtabliſhed an Academy, at the Head of which he placed the famous Monſieur *Leibnitz*, both theſe Brothers were made Fellows of it in the Year 1701. Tho' they were abſent they have always fulfilled the Duty of Academiſts by their excellent and ſingular Tracts, with which they have enriched our Hiſtory. In that of the Year 1702. we publiſhed the *Indefinite Section of the Circular Arches of Monſieur* Bernoulli *of* Baſil. In 1703, his *Theory of the Centre of Oſcillation*; and in the preſent Year, we have ſeen his new Hypotheſis of the Reſiſtance of Solids, and the Analyſis of his Elaſtick Curve. In the *Acts of Leipſic* he had already given ſome Idea, but imperfectly, of the greateſt part of theſe Diſcoveries, but he did not communicate them to the Academy, 'till he had put them into ſuch a Condition as was to his own Satisfaction.

Whilſt the Profeſſor of *Baſil* raiſed himſelf ſo great a Name, his Brother, Profeſſor alſo of Mathematicks at *Groningen*, made no leſs Noiſe; they both ran the ſame Courſe and with equal Paces. The Learned Men of the firſt Rank could hardly attain to that Degree, if they were not paſſionately affected for their particular Science, and had a taſt for it ſuperior to every thing elſe. A lively Emulation excited it ſelf between the two Brothers, which was yet more fomented by their Diſtance, and brought them to ſpeak to one another only in the Publick Journals, and might have ſerved to create a Miſunderſtanding, if that could poſſibly have happen'd between two ſuch dear Friends. At laſt the eldeſt Brother gathering his whole ſtrength together, ſhot out, as I may call it, a Problem, which he directed not only to all the Geometricians, but likewiſe to his Brother in particular, promiſing him publickly a certain Sum if he could reſolve it. He did it, and very quickly too, but gave the Solution without an Analyſis. Monſ. *Bernoulli* of *Baſil*, who found this Solution to be partly different from his own, deſired to ſee the Analyſis of it, that he might diſcover from whence aroſe the Difference of the Solutations:

But ſo many difficulties intervened about the Judges that were to examine this Analyſis, and ſome other Circumſtances of the Judgment, that they have not yet been determined; the Detail of it would be too long, it may therefore ſuffice, that the Publick be informed that this Problem related to the Figures called *Iſoperimeters*. Amongſt an Infinity of poſſible Curves, which have the ſame *Perimeter* or the ſame Length, it was neceſſary to find out by ſome General Rule, thoſe, which under certain Conditions, included the greateſt or ſmalleſt Spaces, or by revolving about their Axis, produced the greateſt or the ſmalleſt Superficies, or the greateſt or ſmalleſt Solids. One may gueſs at the Difficulty of the Problem, by the Deſign wherewith it was choſen.

'Twas this Mr. *Bernoulli* who had the care of the Edition of *Deſcartes* his Geometry, which was publiſh'd at *Baſil*: He was ſo full of theſe Matters, that the Proofs which he had to correct, could not paſs through his Hands without producing new Thoughts and Reflections; and he embelliſhed the Works of that great Philoſopher, which tho' they were done in haſt, and as he calls them Tumultuary, are yet very Curious and Inſtructive.

His continual Labours, occaſion'd by the Duties of his Place, by his Thirſt after Knowledge, and the Pleaſure he took in his Succeſs, were probably the cauſe of the Gout, which ſeized upon him very early, and ended at laſt in a ſlow Fever, of which he died the 16th of *Auguſt*, 1705. Aged fifty Years and ſeven Months. Two or three Days before his Death, at the time of his moſt ſerious Cares, he intreated Monſ. *Herman* his Countryman, particular Friend, and an illuſtrious Geometrician, to return his Thanks to the Academy of Sciences, for the Honour of having admitted him into their Body, and according to the Example of *Archimedes*, who would adorn his Tomb with the fineſt Diſcovery he had made in Geometry, and order'd, that a Cylinder circumſcribed to a Sphere ſhould be drawn upon it; Monſ. *Bernoulli* likewiſe order'd, that there ſhould be put upon his, a Logarithmical Spiral with theſe words, *Eadem mutata reſurgo*, a happy alluſion to the Hope of Chriſtians repreſented in ſome manner by the Properties of this Curve. He finiſhed a great Work *De Arte Conjectandi*; and tho' nothing of it has yet appeared, we ſhall venture to give ſome Idea of it upon the Credit of Monſ. *Herman*. The Rules of any Play being ſuppoſed, and the Players being of equal Strength, one may, in what condition ſoever the Game be, determine by the Advantage which one of the Gameſters has over the other, what odds are to be laid that he ſhall win. The Wager changes according to the different Conditions of the Parties, and when one will conſider all theſe Changes, one finds ſometimes *Series* or Sequels of regulated Numbers, and even of new and ſingular ones. If you ſuppoſe the Gameſters to be unequal, the Queſtion will be, what Odds the Stronger ought to give the Weaker, or reciprocally, a certain Advantage being granted by one to another; the Queſtion will be, how much ſtronger he that gives is than he that takes, and it muſt be obſerved that the Odds or the Strength are incommenſurable, ſo that the two Gameſters can never be made entirely equal. The Ratiocinations which theſe ſort of Matters require, are uſually very nice and fine, and compoſed of a great number of Views, ſome of which may be loſt, and conſequently more ſubject to Error than other Mathematical Reaſonings. For Example, two equal Gameſters having agreed to play four Setts each, and one has got three and the other two, the reaſoning muſt be very nice to determine exactly that one may lay three upon his Head that has got three Games, and one upon his that has got two; This is one of the moſt ſimple Caſes, but by this you may judge of thoſe that are infinitely more complicated: Some great Mathematicians, and chiefly Meſſieurs *Paſchal* and *Huygens*, have already propoſed or reſolved ſome Problems upon this Subject, but they have only ſkim'd, as I may ſay, and not enter'd into the Matter; but Monſ. *Bernoulli* has taken a greater Compaſs, and ſounded it more deeply, he has even carried it to Moral and Political Things, and it is thoſe which will be found the moſt new and ſurpriſing in his Work. In the mean time, if we more cloſely conſider the Affairs of Life, upon which we are to deliberate daily, we ſhall find that we ought to proceed in thoſe Deliberations as in our Wagers about Playing, that is, we ſhould compare the number of Caſes, in which a certain Event will happen, to the number of thoſe in which it will not come to paſs; that being done, one ſhould know exactly, and one might expreſs by Numbers how much better Party would be that we embrace, than that which we reject. All the Difficulty is, that many Caſes eſcape us in which the Event might equally happen, or not happen, and the more there are of theſe unknown Caſes, the more uncertain is the Knowledge which Side we ought to take. The Train of theſe Idea's led Monſ. *Bernoulli* to this Queſtion, Whether the Number of unknown Caſes always leſſening, the probability of the Side one ought to take, does neceſſarily increaſe in Proportion, ſo that at laſt, it arrives to ſuch a degree of Certainty as one would have it? It ſhould ſeem that there was no Difficulty in maintaining the affirmative of this Propoſition; nevertheleſs Monſieur *Bernoulli*, who was fully Maſter of the Matter, aſſured us, that this Problem was much more difficult than that of *Squaring the Circle*, as it would in Compariſon be much more uſeful; for it is not ſo glorious for the Spirit of Geometry to reign in Natural Philoſophy, as it would be in matters of Morality, which are very complicated, caſual and changeable, and the more obſtinate and ſtubborn the Matter it has to deal with, is the greater Honour it would acquire in overcoming it.

Monſ. *Bernoulli* was of a bilious and melancholly Temper, a Diſpoſition which above all others produces in the Mind that Ardour and Conſtancy which are ſo neceſſary for great Things: It produces in a Man of Letters an aſſiduous and obſtinate Study, and by that ſame Study fortifies itſelf more and more. In all the Enquiries and Diſcoveries which Monſ. *Bernoulli* made, his Steps were ſlow, but ſure; neither his Genius, nor habitual Succeſs inſpired him with Confidence: He publiſhed nothing which he did not ſtrictly examine over and over, and he always ſtood in fear of the Opinion of that World which had ſhown ſo great a reſpect for his Productions.

He was married at the Age of 30 Years, and left a Son and a Daughter.

His Place of *Foreign Aſſociate* was filled by Monſ. *Bianchini*, one of the Pope's Chamberlains, and Canon of *St. Laurence* in *Damaſo*.

The LIFE of Monſieur AMONTONS.

WIlliam Amontons* was Born in the Year 1663. He was the Son of a Lawyer, who having left *Normandy* which was his Country, came and ſettled at *Paris.* Whilſt he was in his Studies, he fell into a Diſtemper which made him ſo deaf, that it obliged him almoſt to quit all ſort of Company, at leaſt all unneceſſary Company. Thus being reduced to live by himſelf, and having none but his own Meditations for his Companions, he began to turn his Thoughts towards the *Mechanicks*, and undertook at firſt the moſt difficult of all Machines, or rather the only impoſſible one, I mean that of the *Perpetual Motion*, of which he neither knew the Impoſſibility, nor the Difficulty. Whilſt he was at work at it, he eaſily diſcover'd that there ought to be ſome Principles in this Matter, and that unleſs he knew them, he loſt both his Time and Pains. He ſet himſelf then to Geometry, tho' according to the Cuſtom of all Families, his own oppoſed him in it, and not without reaſon certainly, if People apply themſelves to Sciences only with a deſign to make their Fortune.

We are aſſured that he would never make uſe of any Remedy againſt his Deafneſs; whether it was that he deſpaired of being cured, or that he found his account in the redoubling of his Application and Attention, which that Deafneſs was the occaſion of; like one of the Ancients who was ſaid to have put out one of his Eyes that he might not be diverted from his Philoſophical Meditations. Monſ. *Amontons* learned *Drawing*, *Meaſuring* and *Architecture*, and was employed in ſeveral Publick Works; but he was not long without raiſing himſelf higher, for to that mechanical Science, which produces our ſeveral Arts, and is only employed about our neceſſary Affairs, he joined the Knowledge of the Sublime *Mechaniſm* of the Univerſe.

The Inſtruments, ſuch as Barometers, Thermometers, and Hygrometers, made uſe of in meaſuring Phyſical Variations, which not long ſince were either wholly unknown to us, or only known by the confuſed and uncertain relation of our Senſes, are perhaps, among all the uſeful Inventions of Modern Philoſophy, thoſe in which the application of the Mechanicks to natural Philoſophy is moſt nice; beſides as we were contented with the firſt lucky Hit, or with the firſt Idea which theſe Inventions happily produced, they remained either Defective in themſelves, or very little uſeful. Monſ. *Amontons* ſtudied them very diligently, and in the Year 1687, when he was but 24 Years old, he preſented the Academy with a new *Hygrometer*, which was very much approved by them.

He likewiſe propoſed to Monſieur *Hubin*, a famous Enameler, and a very skilful Man in theſe Matters, the different Idea's he had for new *Barometers* and *Thermometers*, but Monſieur *Hubin* had prevented him in ſome of his Projects, and did not much regard the reſt, 'till he took a Journey into *England*, where the ſame things were propoſed to him by ſome of the principal Members of the *Royal Society*.

Perhaps it will not be look'd upon any otherwiſe than as an Amuſement or Paſtime of the Mind, but however a very ingenious one, that he invented a Method of communicating the Thoughts of one Perſon to another at a very great Diſtance: For Example, from *Paris* to *Rome*, in ſo ſhort a Time as three or four Hours, in ſuch a Manner, that thoſe who liv'd between ſhould know nothing of the Matter; and yet this Propoſition ſo paradoxical, and ſo chimerical in Appearance, was executed in a ſmall Extent of Country, once before the Duke of *Orleans*, and at another time before the Dutcheſs; for tho' Monſieur *Amontons* did not at all underſtand the Art of making his Court to great Men, yet his Merit had already made him known to ſeveral Great Princes.

The Secret conſiſted in placing People in ſeveral Poſts, at certain Diſtances from each other, who by the Help of Teleſcopes, could perceive certain Signals at the Poſt before them, and tranſmit them to the next behind 'em, and ſo on; theſe different Signals, were ſo many Letters of an Alphabet, of which they only had the Cypher at *Paris* and at *Rome*. The great Reach of the

Teleſcopes, made the Diſtance of the Poſts; the Number of which, was to be as few as poſſible; and as the ſecond Poſts tranſmitted the Signals to the third, as ſoon as ever he receiv'd them from the firſt, the News was carry'd from *Paris* to *Rome* in almoſt as ſhort a time as was neceſſary to make the Signals at *Paris*.

In 1695, Monſieur *Amontons* publiſh'd the only Book that we have printed of his, and dedicated it to the *Academy of Sciences*, the Title of which is, *Phyſical Obſervations and Experiments upon the Conſtruction of a new Hour-Glaſs, and upon Barometers, Thermometers, and Hygrometers*. Altho' the *Clepſydra's*, or Water-Hour-Glaſſes, ſo much in Uſe among the Ancients, have been quite laid aſide by us, on Account of the Clocks with Wheels, which are much more exact and convenient, Monſieur *Amontons* did nevertheleſs take a great deal of Pains in forming his *Clepſydra*, hoping that it might be of Service upon the Sea; for as he had made it, the moſt violent Motion of a Ship, which infallibly diſorders all Clocks, could not affect this Machine. One may ſee in his Book with how much Art that *Clepſydra* was prepar'd; nor is it likely that it interfered with many of the ancient Inventions.

He was admitted into the Academy in the Year 1699, at the time when the King gave them their new Rules. Soon after which, he produc'd, at one of the Meetings, his Theory of *Frictions*, which has given ſo much Light to a Matter that has hitherto been obſcure, and yet of great Importance in the Mechanicks. That was ſucceeded by his new *Thermometer*, an Invention which is not only uſeful in the Practice, but has alſo furniſh'd us with new Views for Speculation. Our Hiſtories have ſpoken fully of theſe Diſcoveries, and given an Account of his Rectify'd Barometer, and of his Barometer without Mercury, for the Uſe of the Sea, and of the new and curious Experiments he has made about the Nature of the Air.

Monſieur *Amontons* had a ſingular Talent for Experiments, fine and happy Notions of Things, and a great many Expedients to remove any Inconveniencies, and great Dexterity in executing his Projects, ſo that it ſeem'd as if Monſieur *Mariot*, ſo famous for the ſame Talents, had been reviv'd in him.

We do not therefore ſcruple to compare a ſimple *Pupil*, ſuch as Monſieur *Amontons*, was to one of the greateſt Members that ever our Academy had; nor does the Name of *Pupil* imply any Diſtinction of Merit among us, nor ſignify any thing more than a leſſer Degree of Seniority, and a kind of Survivance. Monſieur *Amontons* enjoying a perfect Health, which even ſhew'd it ſelf by all the External Appearances, and not being Subject to any Diſeaſe, leading, and having always led the moſt regular Life in the World, was all of a ſudden ſeiz'd by an Inflammation of the Bowels, which turn'd to a Mortification in a very few Days. He died the 11th of *October* 1705, at the Age of 42 Years, and about two Months.

The Publick loſes by his Death ſeveral uſeful Inventions he was about, *viz.* upon the Printing-Preſs, upon Ships, and upon Waggons, or Carriages. What has appear'd of his may ſecure us, that whatever he thought poſſible would certainly ſtand any Trial, and the Spirit of Invention naturally ſubtle, bold, and ſometimes preſumptuous, was in him accompany'd with all the Solidity, all the Modeſty, and even all the Diffidence neceſſary to it.

The Qualities of his Heart were yet preferable to thoſe of his Mind; there was ſo natural and ſo unaffected a Sincerity in it, that it was impoſſible to be deceiv'd by it; a Simplicity, Freedom, and Candour, which the ſmall Correſpondence he had with Men might preſerve, but could not beſtow upon him; he was intirely uncapable of ſetting himſelf out otherwiſe than by his Works, or of making his Court otherwiſe than by his Merit, and, by Conſequence, almoſt entirely uncapable of raiſing a Fortune.

The LIFE *of Monſieur* DUHAMEL.

JOhn *Baptiſt Duhamel* was born in the Year 1624, at *Vire*, in the Lower *Normandy*. *Nicholas Duhamel* his Father was a Lawyer in the ſame Town, where, without any regard to his private Intereſt, his chief Care was to make up thoſe Quarrels that were brought to him, which ſometimes occaſion'd others between him and the Judges of the Place.

Monſieur *Duhamel*, the Son, perform'd his firſt Studies at *Caën*, but learned Rhetorick and Philoſophy at *Paris*. At the Age of 18 Years, he compoſed a little Treatiſe, in which he explain'd, with one or two Figures, and after a very eaſy Manner, the three Books of *Sphericks of Theodoſius*; he added to it a very ſhort and plain *Trigonometry*, with a Deſign to facilitate the Entrance into *Aſtronomy*. In one of his later Works, he ſays, That the Vanity of Youth ſtirred him up to publiſh the other; but few People of the ſame Age are troubled with ſuch ſort of Vanity. The Inclination which carry'd him to the Sciences, muſt have been already very general, and very far extended, ſince it did not ſuffer him to paſs by the Mathematicks, ſo little known, and leſs cultivated in thoſe Times and Places in which he ſtudied.

At the Age of 19 Years he was admitted into the Convent of the Fathers of the Oratory, there he remain'd ten Years, and left it for the Parſonage of *Neüilli*, upon the *Marne*. Between theſe two Periods he join'd to the Duties of his Functions a great Application to Reading.

Natural Philoſophy was at that Time like a great Kingdom diſmember'd; the particular Provinces or Government whereof were become almoſt independent Sovereignties. *Aſtronomy*, *Mechanicks*, *Opticks*, *Chymiſtry*, *&c.* were diſtinct Sciences, and had nothing in common with that which is call'd *Phyſicks*, and even the Pyſicians themſelves had ſeparated from it their Philoſophy, the Name alone of which betray'd it. *Phyſicks* being thus depauperated and ſtripp'd, had nothing belonging to it but Queſtions equally thorny and barren. Monſieur *Duhamel* therefore undertook to reſtore to this Science that which had been uſurp'd from it; that is to ſay, an infinite Number of uſeful and agreeable Knowledges, proper to revive that Eſteem and Reliſh which was due to it. He began to execute this Deſign by his *Aſtronomia Phyſica*, and by his Treatiſe, *De Meteoris & Foſſilibus*, both of 'em printed in the Year 1660.

Theſe two Treatiſes are Dialogues; the Speakers of which, are *Theophilus*, a great Admirer of the Ancients, *Menander*, a zealous *Carteſian*, and *Simplicius* a Philoſopher, and an indifferent Man between all Parties, whoſe chiefeſt Taſk was to bring them all to an Agreement, and who moreover by Virtue of his Character, was to cull from all their Hypotheſes ſuch things as he judg'd the beſt. This *Simplicius*, or Monſieur *Duhamel*, is the ſame Perſon.

From the Form of his Dialogues, and his Manner of handling Philoſophy, one may diſcover that *Cicero* was his Pattern; but it is yet more obvious by the pure accurate Latinity of them, and which is yet more important, by the great Number of fine and ingenious Expreſſions that frequently occur in thoſe Works, which are Philoſophical Diſcourſes diveſted of their Natural, or at leaſt uſual Drineſs, by paſſing thro' a rich and flowry Imagination; from which, however, they have only borrow'd that juſt Doſe of Agreeableneſs, which was neceſſary to ſet them off. Thoſe things which are to be eſtabliſh'd to a certain Degree only, are what always coſt the moſt Pains.

His *Phyſical Aſtronomy* is a Collection of the principal Thoughts of the Philoſophers both ancient and Modern, upon Light, Colours, and upon the Syſtems of the World; and beſides every thing that belongs to the Globe, to the Theory of Planets, and to the Calculation of Eclipſes, are thereby Mathematically explain'd.

So likewiſe his Treatiſe of *Meteors* and *Foſſils*, is a Collection of all that any Authors of ſome Reputation have writ upon thoſe Matters; for Monſieur *Duhamel* did not confine himſelf to the moſt eminent. In his Diſcourſe about *Foſſils*, we may obſerve a great Knowledge of Natural Hiſtory, and eſpecially of Chymiſtry, tho' this latter Art was in thoſe Times involv'd in Myſteries and Darkneſs, which could not eaſily be penetrated.

He has been reproach'd of being too ſevere upon the great *Deſcartes*, a Man ſo worthy of Reſpect from all the Philoſophers, even ſuch as do leaſt agree with him. Indeed *Theophilus* does ſometimes treat him ſevere enough, for which Monſieur *Duhamel*'s Apology is, That the Part which *Theophilus* acted, was of a Perſon entirely partial to Antiquity, and incapable of any Modern Taſt; but that *Simplicius* never treated him ill, and therein he ſaid true, tho' at the Bottom, 'twas *Simplicius* that put Words into the Mouth of *Theophilus*.

In 1663, which was the ſame Year that he left his Living of *Neüilli*, he publiſh'd his famous Book, *De Conſenſu veteris & novæ Philoſophiæ*. 'Tis a general Account of *Phyſicks*, or a Treatiſe of Firſt Principles. What the Title promiſes, is fully perform'd, and the Spirit of Reconciliation, hereditary to the Author, triumphs throughout the whole Work. He begins with the ſublime and ſcarce intelligible Metaphyſicks of the Platonicks, about Ideas, Numbers, and Architypical Forms; and tho' Monſieur *Duhamel* does acknowledge the Obſcurity of them, yet he cannot refuſe them a Place in this kind of *States-General* of Philoſophy. He treats with the ſame Moderation the Principle of Privation, the Eduction of ſubſtantial Forms, and ſome other Scholaſtick Notions; but when he comes at laſt to thoſe Principles that are to be underſtood, that is either to the Laws of Motion, or to the leſs ſimple Principles laid down by Chymiſts, one perceives, in ſpight of his Inclination to accommodate Matters among all Parties, he naturally lets the Scale turn on this Side. One may even perceive, that it is with Unwillingneſs he enters into thoſe general Diſputes, which in Effect are only about *Words*; the only Merit of which is, that they have a long time paſs'd for *Things*. His Inclination and his Learning, upon thoſe Occaſions, do always hurry him back to Experimental Philoſophy, and eſpecially to Chymiſtry, in which he ſeems to have taken a particular Delight.

In 1666, Monſieur *Colbert*, who knew how much the Glory of Learning contributes to the Splendour of the State, propoſed to the King, and obtain'd his Majeſty's Approbation for the Eſtabliſhment of a *Royal Academy of Sciences*; and got together, with a ſingular Judgment, a ſmall Number of Men; among whom, each one excelled in his kind: There was wanting to this Society, a Secretary, that could underſtand and readily ſpeak all the different Languages of theſe learned Men, of a *Chymiſt* for Example, or of an *Aſtronomer, &c.* and ſuch a one as might be their common Interpreter to the Publick, and that could give to ſo many thorny and abſtracted Matters a Light, and a certain Turn, and even an Agreeableneſs too, which many Authors neglect, and yet which moſt Readers expect; finally ſuch a one, who by his Character, was wholly free from Partiality, and fit to give a diſ-intereſted Account of the Debates of that Academy. The Choice that Mr. *Colbert* made to perform that Function, fell upon Monſieur *Duhamel*; and indeed after the Proofs he had given without Deſign, of all thoſe neceſſary Qualities, a Choice made by ſo judicious a Perſon, could not fall upon any other than him.

His Skill in the *Latin* Tongue having ſhin'd thro' all his Works, and become the more remarkable, as the Subject thereof was leſs favourable, he was choſen to tranſlate into that Language, *A Diſcourſe about the Rights of the late Queen upon* Brabant, Namur, *and ſome other Lordſhips of the* Spaniſh *Low-Countries.* The King, who caus'd it to be publiſh'd in the Year 1667, was deſirous it might be read in all thoſe Parts of *Europe* where his Conqueſts, and perhaps a great Number of excellent Books had not yet render'd the *French* Language ſo familiar as it is become ſince.

To this Work which ſupported the Rights of the Queen, there ſucceeded the next Year another by the ſame Hand, and in *Latin*, in Defence of thoſe of the Archbiſhop of *Paris*, againſt the pretended Exemptions of the Abbot of St. *Germains des Prez.* 'Twas Monſieur *de Pereſixe*, the then Archbiſhop, who engag'd Monſieur *Duhamel* in this Undertaking, believing, probably, that the Name of an Author, ſo averſe from attacking any Body unjuſtly, that he would ſcarce ſtrike the firſt Blow upon any Account whatever, would very much byaſs the World in Favour of the Archiepiſcopal See. Indeed this was the only time that Monſieur *Duhamel* would be perſwaded to do that Violence to his Character, as to act the Part of an Agreſſor; and it was not amiſs that he ſhould act it once, to ſerve for a Model of that Moderation and good Breeding with which ſuch ſort of Diſputes ought to be carried on.

The great Reputation of his Latinity, was the occaſion that in the Year 1668, Monſieur *Colbert de Croiſſy*, Plenipotentiary for the Peace of *Aix la Chapelle*, took him along with him thither, where he often employ'd him in all thoſe Buſineſſes that were to be treated of in the *Latin* Languages with foreign Miniſters; and tho' the Purity of the Language may appear to be a Circumſtance of no great Moment, with reſpect to the Negociation of Peace, yet Politicians know very well that nothing ſhould be neglected that can raiſe the Character of a Nation in the Eyes of its Neighbours or Enemies.

After the Peace of *Aix la Chapelle*, Monſieur *de Croiſſy* went Ambaſſador to *England*, and took Monſieur *Duhamel* with him. He made that Voyage as a Philoſopher; his chief Curioſity was to ſee the Learned Men, and above all, the illuſtrious Mr. *Boyle*, who open'd to him all his Treaſures of Experimental Philoſophy. From thence he went into *Holland* for the ſame Purpoſe; and in thoſe two Voyages he acquir'd the Riches with which he afterwards adorned his Books.

Being return'd to *France*, and in Poſſeſſion of his Place of Secretary to the Academy, he publiſh'd his Treatiſe *De Corporum Affectionibus*, in the Year 1670. There he carry'd on his Philoſophy as far as to the Knowledge of Medicines, and was not contented barely to touch upon the Principles of it; two Years afterwards he publiſh'd his Diſcourſe, *De Mente Humana*, which is a *Metaphyſical Logick*, or a Theory of Human Underſtanding, and of Idea's, with the Art of guiding our Reaſon: Now tho' Philoſophical Experiments may ſeem to be foreign to this Subject, yet they are plentifully made uſe of by him, furniſhing him with all the Examples he ſtood in need of; and he was ſo full of them, that they ſeem'd to overflow every Moment.

The next Year, that is to ſay in 1673, appeared his Book *De Corpore Animato*. One may eaſily judge by the Title, that Experimental Philoſophy abounds every where in it, and ſo does Anatomy too, of which Monſieur *Duhamel* had acquir'd a great Knowledge both by the Conferences of the Academy, and by a particular Correſpondence which he maintain'd with Monſieur *Steno* and *du Verney*. When Monſieur *du Verney* began to ſettle at *Paris*, and at the ſame Time eſtabliſh'd a new Taſt for Anatomy, Monſieur

Duhamel was one of the firſt that laid hold upon him, and the Diſcoveries he brought with him. Such a Diſciple ſpurred on the young Anatomiſt to a much greater Progreſs, and likewiſe contributed thereto.

In this Book *De Corpore Animato*, he takes Notice of his being reproached for leaving Diſputes undetermin'd, and being too indifferent himſelf between all Parties, and promiſes to mend that Fault; but we muſt confeſs he does not ſeem to have kept his Word too much. It is a Fault however that few Philoſophers are guilty of.

In the ſame Place, he charges himſelf with another Fault, and is much more concern'd at it; which was, that he being a Clergy-man, ſhould ſacrifice ſo much of his Time to profane Philoſophy. It is eaſie to ſee that he could have juſtify'd himſelf with a Cloud of Reaſons, but none of them did ſatisfy the extream Tenderneſs of his Conſcience. He declares, that he will return to a Work of Divinity, of which he had form'd a Scheme from the very time of publiſhing his firſt Books, but that the Execution of it had always been prevented.

Notwithſtanding which, he met with a new Interruption. A ſuperior Command, and very honourable to him, oblig'd him to compoſe an entire Courſe of Philoſophy, according to the Forms uſed in Colleges. This Work appear'd in 1678, under the Title of *Philoſophia vetus & nova ad uſum Scholæ accommodata in Regia Burgundiæ pertractata:* And is a Collection as judicious and happy as poſſible, of the ancient Idea's and of the new; of the Philoſophy of Words, and of that of Things; of the Schools, and of the Academy. And to ſpeak yet more juſtly of it, Meaſures are kept with the Schools, but the Academy predominates. Monſ. *Duhamel* has diſperſed throughout the whole Work all that he had gather'd in the Debates of the Society, Experiments, Diſcoveries, Reaſonings, and Conjectures. The Succeſs of the Work has been proportionably great; the new Syſtems in a manner diſguiſed, or intermixed with the old, have been more eaſily admitted by the Enemies of them; and perhaps Truth it ſelf has met with leſs oppoſition for being ſupported, as it were, by Error.

Several Years after the Publication of this Book, ſome Miſſionaries that carried it with them to the *Eaſt-Indies*, writ hither that they had taught that Philoſophy with very good Succeſs, particularly the Phyſicks, which among the four Parts of the entire Courſe, is that wherein the Academy and the Moderns are moſt concerned. People that were little inſtructed, and only guided by their natural Taſt, did not long halt between the two Kinds of Philoſophy, one of which has reigned ſo many Ages among us.

It looks as if Monſ. *Duhamel* was doomed to be the Philoſopher of the Eaſt. Father *Bouvet*, a Jeſuit and famous Miſſionary of *China* writes, that when his Brethren and he compoſed in the *Tartarian* Language, a Body of Philoſophy for the Emperor, and that vaſt State, in order to lead them by that means into the Truths of the Goſpel, one of the chief Springs they made uſe of, was the Ancient and Modern Philoſophy of Monſ. *Duhamel*, who ought therefore to be comforted for the Pains he had taken about it; ſince it open'd a Way in thoſe Countries for the admiſſion of the Chriſtian Religion.

At laſt however he diſcharged himſelf more punctually of the Duty he had laid upon himſelf; for in the Year 1691, he Publiſhed a Body of Divinity in Seven Tomes with the following Title, *Theologia Speculatrix & Practica Juxta SS. Patrum dogmata pertractata & ad uſum Scholæ accommodata.* Divinity has been long filled with Subtilties which indeed were very ingenious, and even uſeful in ſome Degree; but very often too exceſſive; and at the ſame time, People neglected the Study of the Fathers, Councils, Hiſtory of the Church, in a word all that they now call Poſitive Divinity; they went as far as they could go by the Metaphyſicks alone, and without the help of Facts, almoſt wholly unknown, and this Divinity may be properly called the *Daughter of the Mind and of Ignorance*; but at laſt the more wholeſom and more nice Views of the two laſt Ages, have made the Poſitive Divinity prevail. Monſ. *Duhamel* in his Work has united it with that of the Schools, and no body was more fit to bring about this Re-union; for what Experimental Philoſophy is, with reſpect to the Scholaſtick, the ſame is the Poſitive Divinity, with reſpect to the old School Divinity; 'tis the Poſitive that gives ſtrength and ſolidity to the Scholiaſtick, and Monſ. *Duhamel* did exactly the ſame for Divinity as he had done for Philoſophy; on one ſide and on the other we ſee the ſame extent of Knowledge, the ſame Inclinations, and the ſame Endeavours to reconcile Opinions, the ſame Judgment in chuſing where it is neceſſary; finally, the ſame Soul acting upon different Matters. One may therefore repreſent to ones ſelf from this Work what it is to be a Philoſopher and a Divine all at once; a Philoſopher embracing the whole Body of Philoſophy, and a Divine taking in the whole Compaſs of Divinity.

This almoſt immenſe Labour engaged him in another. He was deſired to make an Extract from his Body of Divinity of ſuch things as were moſt neceſſary for young Clergymen whilſt they were inſtructed in the Seminaries: Being ſenſible of the Uſefulneſs of ſuch a Deſign, he undertook it, tho' he was at that time Seventy Years old, and ſubject to an Infirmity which from time to time brought him to the brink of his Grave; Nay, he did more than was expected of him, for he treated of ſeveral Matters which were not at all in his Firſt Work, and made it almoſt a New one, and publiſhed it in the Year 1694, under this Title; *Theologiæ Clericorum ſeminariis accommodatæ ſummarium.* This Summary contains Five Volumes.

This Application to Divinity was no Interruption to his Academical Duties. He did not only continue in the Exerciſe of his Function as Secretary, and in regiſtring the Tranſactions of every Meeting, but he alſo undertook to compoſe in Latin a general Hiſtory of the Academy, from its Eſtabliſhment in the Year 1666, down to the Year 1696. He made thoſe Years the Period of his Hiſtory, becauſe he reſigned his Office in 1697, having repreſented to Monſ. *Pontchartrain*, Chancellor of *France*, that he was become ſo Infirm, as to ſtand in need of a Succeſſor. It would be my Intereſt to conceal in this place the Name of the Perſon that durſt ſucceed ſo great a Man, but the Obligations I lye under to him for his Goodneſs in approving, and his Care in forming me, will not allow it.

'Twas in the Year 1698, that his Hiſtory appeared under this Title, *Regiæ Scientiarum Academiæ Hiſtoria*, the Edition was ſoon ſpent, and in 1701, there came out a Second much larger, being augmented with the four Years that were wanting to compleat the Century; the two laſt of which are comprehended in the *French* Account of the ſame.

If the Date of his Books were not an inconteſtable Proof, we could hardy be ſo bold as to aſſert, that in the ſame Year 1698, in which he publiſhed the Firſt Edition of his Hiſtory of the Academy; he alſo gave us a very Learned Theological Work entitled, *Inſtitutiones Biblicæ, ſeu Scripturæ ſacræ Prolegomena, unà cum ſelectis Annotationibus in Pentateuchum.* In which he has collected all that is moſt neceſſary to be known in the Criticiſm of the Holy Scriptures; a ſure and right Judgment is the Architect that chuſes and diſpoſes of the Materials which a vaſt Erudition ſupplies it with; the ſame Character reigns throughout the Notes upon the five Books of *Moſes*, being conciſe and well choſen, inſtructive and only curious in order to inſtruct the better; Learned without Pomp, and intermingled ſometimes with Sentiments of Piety, which proceeded as naturally out of the Heart of the Writer, as from the Subject it ſelf.

In 1701. he publiſhed the *Pſalms*, and in 1703. the *Proverbs*, *Wiſdom* of *Solomon* and *Eccleſiaſtes*, with the like Notes; all theſe Treatiſes were only the Fore-runners of another vaſtly greater, upon which he was at work, that is, of the whole Bible, with Notes upon all thoſe places that required it, and ſuch Notes as he was able to give; this appeared in the Year 1705, when he was of the Age of 81. This Bible, both by the Beauty of the Edition, and by the Convenience and Uſefulneſs of the Comment, placed at the bottom of every Page, does, in the opinion of the Learned, far exceed all thoſe that have been yet publiſhed.

Being arrived to ſo great an Age, and having acquired a greater Right to a Glorious *Quietus* than any other whatever, but being uncapable to live idle, he intended to have continued to turn into Latin the French *Hiſtory of the Academy*, and he had already begun to Tranſlate the general Preface, but was prevented by an eaſie and gentle Death, proceeding only from the bare Neceſſity of Dying, which happen'd upon the 6th of *Auguſt*, 1706.

Hitherto we have only deſcribed him as a Man of Learning and Member of the Royal Academy: We ſhould now repreſent him as a Man, and give ſome account of his Morals, but to do that we muſt make the Panegyrick of a Saint; we are not therefore worthy to ſpeak, upon this Part of his Elogium, which ought to be performed in a Church, and not in a Philoſophical Meeting; we ſhall only hint at two Facts, that may be related by a Prophane Mouth.

He went once a Year to viſit his old Flock at *Neüilli* upon the *Marne*, and that Day was kept as a Feſtival throughout the whole Village; nobody would work, and they were wholly taken up with the Pleaſure of ſeeing him. All the World knows what are the Virtues, not only Moral but Chriſtian, neceſſary to make a good Paſtor, and to procure him ſo great an Aſcendant over the Hearts of his People, and of what value are the Praiſes of thoſe over whom one has had an Authority once, but has none any longer.

Whilſt he was in *England*, the *Engliſh* Catholicks which uſed to frequent the Chapel of the *French* Ambaſſador would commonly ſay, *Let us hear Maſs from the Holy Prieſt.* Theſe Foreigners did not want a long time to form ſuch a Notion of him as he deſerved; an external Simplicity, and which he could not be ſuppoſed to affect, diſcover'd his internal Virtues, and betrayed the Deſire he had of concealing them: It was eaſie to perceive that his Humility did not conſiſt in Words and Diſcourſes, but in his real Sentiments, and was founded even upon his Learning; and his Charity was too often exerted not to be, in ſpight of all his Precautions, very plain and viſible; the general Deſire he had of being uſeful to others was ſo well known, that the favourable Characters he gave of Perſons, loſt part of their juſt weight, becauſe they came from him.

Cardinal *Anthony Barberin*, great Almoner of *France*, made him one of the King's Chaplains in the Year 1656, which we had forgot to take notice of, tho' it is a Circumſtance that ought not to have been omitted in the Life of any other Perſon.

He was all his time in great Eſteem with the Chiefeſt of our Prelates: Notwithſtanding which, he was never poſſeſſed of any but very ſmall Benefices, which ſtill helps to illuſtrate his Character; for the laſt Stroak of which, I ſhall add, that he never was poſſeſſed of any whereof he did not diveſt himſelf for the ſake of ſomebody or other.

The Office of Penſioner *Anatomiſt* which he enjoyed in the Academy, has been filled by Monſieur *Littre*; and that of *Aſſociate Anatomiſt* enjoyed by Monſ. *Littre*, was given to Monſ. *du Vorney* the Younger, who was Monſ. *Duhamel*'s *Pupil.*

The LIFE *of Monſieur* REGIS.

PEter Silvan Regis was born in the Year 1632, at *La Salvetat de Blanquefort* in the *Agenois.* His Father was in very good Circumſtances, and liv'd to the top of 'em; but as he had a great many Children, ſo he left but a very ſmall Fortune to our Monſ. *Regis*, who was one of the Youngeſt.

After having with Reputation gone thro' the Studies of Humanity and Philoſophy in the Jeſuits College at *Cahors*, he apply'd himſelf to Divinity in the Univerſity of *Paris*, being deſigned for a Clergyman; and he became ſo great a Maſter of it in four Year's time, that the Body of the Univerſity ſollicited him to take his Doctor's Degree, offering to bear the Expence of it themſelves. But he did not think himſelf worthy of it till he had ſtudied in the *Sorbonne*: Thither he went, but being diſguſted at the exceſſive tedioufneſs of that which was dictated to him by a famous Profeſſor, only upon the Queſtion of the Time when the *Euchariſt* was inſtituted, and being taken with the *Carteſian-Philoſophy*, which he juſt then began to know by his Converſation with Monſ. *Rohaut*, he abandon'd himſelf wholly to that Philoſophy, the Charms of which, abſtracted even from its Novelty, could not fail to become very agreeable to ſuch a Genius as his. He had not above four or five Months to ſtay at *Paris*, ſo that he made haſt to be inſtructed by Monſ. *Rohaut*, who on his Side, being zealous for his Doctrine, took a great deal of pains with a Diſciple whom he found ſo fit to propagate it.

Monſ. *Regis* having left *Paris* with a kind of a Miſſion from his Maſter, went to eſtabliſh his new Philoſophy at *Toulouſe*, by Publick Lectures which he ſet up in the Year 1665. He had an agreeable Facility in Speaking, and the Gift of bringing down the moſt abſtract Matters to the Capacity of his Hearers. The whole Town being preſently alarm'd by our new Philoſopher, the Magiſtrates, Clergymen, and all the Learned ran to hear him, even the Ladies themſelves made part of the Auditory; and if any one ought to ſhare with him the Glory of this great Succeſs, it was at leaſt none but the illuſtrious *Deſcartes*, whoſe Diſcoveries he preached up.

There was a Theſis maintained of pure *Carteſianiſm* in *French*, Dedicated to one of the firſt Ladies of *Toulouſe*, whom Monſ. *Regis* had made a very able *Carteſian*, and he himſelf preſided at that Theſis. The Parties diſputed in *French*, and the Lady her ſelf ſolved ſeveral conſiderable Difficulties, and it ſeemed as if People, affected by all theſe Circumſtances, had reſolved entirely to abjure the ancient Philoſophy.

The Magiſtrates of *Toulouſe* being very ſenſible of the Inſtructions and Lights that Monſ. *Regis* had brought to them, ſettled him a Penſion upon the Town-Houſe, a Thing almoſt incredible in our Age, and Glorious enough for the old *Grecians* and *Romans*.

The Marquis *de Vardes*, at that Time baniſhed into *Languedoc*, being come to *Toulouſe*, and preſently acquainted with Monſ. *Regis*, got leave of the Town, but not without Importunity, to carry him along with him to his Government of *Aigues-mortes*, where he ſtrictly united him to himſelf by his own Merit, and by the Eſteem and Friendſhip, which is for the Glory both of the one and of the other; he had no occaſion to engage him by thoſe other means that commonly paſs for the moſt efficacious. He endeavoured to employ, or rather to amuſe, himſelf with him in the *Carteſian* Philoſophy; and as his Wit had made him ſhine in a Court that knew how to Judge of it, perhaps the Philoſopher did not leſs profit by the Converſation of the Courtier, than the Courtier by that of the Philoſopher, each of theſe two different Characters being uſually compoſed of that which is wanting in the other.

The Marquis *de Vardes* went to *Montpellier* in the Year 1671, and Monſ. *Regis*, who accompanied him thither, read Lectures in that City, with the ſame Applauſe he had done at *Toulouſe*.

But all great Talents muſt finally center in the Capital, whither Monſ. *Regis* came in the Year 1680, and began to hold the ſame Lectures in the Houſe of Monſ. *Lemery*, at preſent one of the Members of the Academy. The Concourſe of People was quickly ſo great, that it became too inconvenient for the Houſe of a private Perſon: Places were taken a great while before the Hour appointed for the Lecture, and perhaps the Severity of this Hiſtory does not forbid me to obſerve, that the moſt agreeable Actor of the *Italian* Play-Houſe, (who when he was off of the Stage, conceal'd the ſerious Spirit of a Philoſopher, under a Mask of an inimitable *Badinage*) was ſeen to frequent thoſe Lectures daily.

'Tis a Fault to ſucceed too well: The Lectures of Monſ. *Regis* made ſuch a Noiſe, as became fatal to them. The late Archbiſhop of *Paris*, out of the Reſpect he paid to the Ancient Philoſophy, ſent him an Order to ſuſpend them, diſguis'd under the Form of an Advice or Requeſt, and ſweeten'd with a great many Commendations. Thus the Publick were depriv'd of theſe Meetings at the End of ſix Months, and in the Middle of their moſt lively Reliſh for them; and ſo perhaps, tho' without Deſign, their Inconſtancy was obviated, and their Eſteem increas'd for what they had loſt.

Monſ. *Regis* being now more free, employ'd all his Thoughts about publiſhing a general Syſtem of Philoſophy which he had compoſed, and which was the principal Occaſion of his Journey to *Paris*. But this Deſign was likewiſe croſs'd during the Space of ten Years; at laſt, with the

Aſſiſtance of Time and Reaſon, he overcame all Oppoſitions, and the Work appear'd in the Year 1690 under this Title, *A Syſtem of Philoſophy, containing Logick, Metaphyſicks, Phyſicks, and Morality*, in three Vols. in 4to.

The Advantage of a general Syſtem is, that it furniſhes the Mind with a more pompous Spectacle, which always delights to look down from a greater Eminency, and to diſcover a larger Extent of Country; but on the other Hand, it is an Evil without Remedy, that Objects view'd at a farther Diſtance, and in a greater Number, are generally moſt confuſed. Different Parts are link'd together, for the Compoſition of a whole, and mutually ſtrengthen'd by ſuch a Union; but then each of them are handled in particular with leſs Care, and ſuffer by being a Part of one general Syſtem. One ſingle Subject well explain'd, might perhaps ſatisfy as well, without reckoning that as ſoon as ever it was well explain'd, it would always become general enough; if one conſiders the Glory of the Author, there remains no more to one that undertakes ſuch a Work, but that of a judicious Compilation, and tho' like Monſ. *Regis*, he might add to it ſeveral new Idea's, the Publick will not take the Pains to diſtinguiſh them from the reſt.

Engaged as he was to defend the *Carteſian* Philoſophy, he publiſhed in the Year 1691, an Anſwer to the Book entitled, *Cenſura Philoſophiæ Carteſianæ*, writ by one of the moſt learned Hands of *Europe*; and the late Mr. *Boyle*, a very good Judge, having ſeen the Anſwer, was of Opinion, that it might ſerve for a Pattern to all that ſhould be undertaken for the Future in the ſame Cauſe. The following Year, Monſ. *Regis* defended himſelf againſt a Learned Profeſſor of Philoſophy, who had attacked his general Syſtem. Theſe two Anſwers which he thought himſelf obliged to give in a very little time, and an Augmentation of more than a third Part, which he had juſt before made to his Syſtem at the very time he was peruſing it, were the Occaſion of his falling into thoſe Infirmities that grew upon him ever after. Thus Philoſophy it ſelf has its Paſſions and Exceſſes that cannot eſcape unpuniſhed.

Monſ. *Regis* was embarked in yet greater Diſputes, on account of his having attacked in his Phyſicks, the Reaſon that Father *Mallebranche* had given in his *Search after Truth*, why the Moon appears bigger at the *Horizon* than it does at the *Meridian?* They writ on both Sides, and the chief Queſtion was reduced between 'em to this Point, Whether the apparent greatneſs of an Object depended ſolely on the greatneſs of its Image painted on the *Retina*, or on the real greatneſs thereof, and the Natural Judgment which the Soul makes of its Diſtance, inſomuch, that all the reſt being equal, ſhe ought to ſee it ſo much the larger as ſhe judges it more remote? Monſ. *Regis* aſſerted the former; Father *Mallebranche* the latter, and maintained, that a Giant ſix Foot higher than a Dwarf, and placed at the diſtance of twelve Foot, would nevertheleſs appear higher than the Dwarf that was placed but two Foot off, in ſpight of the equality of the Images which they both formed in the Eye; the reaſon of which was, one ſees the Giant as more remote on account of the Interpoſition of different

Objects: He would not even allow to Monſ. *Regis*, that the Image of the Moon at the Horizon was augmented by the Refractions, at leaſt in the manner it ought to be for this Phenomenon, and he added different Experiments, by which the Moon ceaſed to appear larger, as ſoon as it was ſeen in ſuch a Way as not to be eſteemed more remote. Monſ. *Regis* however maintained his Opinion, and as Authors, according to the cuſtom of all Diſputes, do multiply their Writings ſometimes very unneceſſarily; Father *Mallebranche* thought he had a Right to determine the Queſtion by way of Authority; but it was ſuch an Authority as might be made uſe of in the Way of Learning. He procured a Certificate of Four of the moſt famous Geometricians, who declared, that *the Proofs he had brought of his Sentiment were Demonſtrative, and plainly to be deduced from the true Principles of Opticks*. The Geometricians were the late Marquis *de L'Hopital*, the Abbot *Catelan*, Monſieur *Sauveur* and Monſ. *Varignon*. Monſ. *Regis* upon this Occaſion acted according to the firſt Suggeſtions of Nature, and endeavour'd to find fault with each of thoſe Gentlemen. The *Journal des Sçavans* of the Year 1664, was the Theatre of this War.

It was likewiſe ſo, at leaſt in part, of another War between the ſame Adverſaries: Monſ. *Regis* in his Metaphyſicks, had often fallen foul upon thoſe of Father *Mallebranche*: One of their chief Diſputes turned upon the Nature of Idea's, upon their Cauſe, whether Efficient, or Exemplary; a Subject ſo ſublime and abſtracted, that tho' the Mind of Man cannot diſcover a ſufficient Certainty in it, yet it is Glory enough to have arrived at well-grounded or reaſonable Doubts. The two Metaphyſicians debated likewiſe, whether *Pleaſure does render us actually happy*, and they were as much divided upon this Queſtion, tho' it be leſs Metaphyſical. As the Works of Father *Mallebranche* had acquired him ſeveral able and zealous Diſciples, ſome of them writ alſo againſt Monſ. *Regis*, who contented himſelf in having enter'd the Liſts with their Maſter.

The Inclination which he always preſerved for Divinity, and his Love of Religion, inſpired him with another Undertaking already attempted many imes by great Men, worthy of all their Efforts, nd of their wiſeſt Ambition, and more neceſſary han ever, in ſo enlighten'd an Age as that we live n. He finiſhed it in the Year 1704, in ſpight of is continual Infirmities, and publiſhed it under his Title in a Quarto Book; *The Uſe of Reaſon nd Faith*, or *the Agreement of Faith and Reaſon.* e dedicated it to the Abbot *Bignon*, to whom he ys in his Epiſtle, *that he could not cite the Ene- ies either of Reaſon or of Faith before a Judge whom the Rights of the one and the other ere better known;* and *that if they refuſed him, e only reaſon would be, becauſe he had already highly declared himſelf in favour both of Faith nd Reaſon.* The Method he takes to bring about difficult an Agreement, is that which a wiſe rbitrator would make uſe of with reſpect to two rothers, between whom he was deſirous to ſtifle l the Seeds of Diviſion. Monſ. *Regis* diſtin- iſhes ſo nicely between *Reaſon* and *Faith*, and ſigns to each of them Objects and Employments ſo different, that they can never have again, as I may ſay, any occaſion of Embroiling themſelves together. Reaſon leads Man even to an entire Conviction of the Hiſtorical Proofs of the Chriſtian Religion; after which ſhe abandons and delivers him up to another Light, not contrary, but quite different and infinitely ſuperior. The Diſtance which Monſ. *Regis* makes Reaſon and Faith keep between themſelves, does not permit them to re-unite in the Syſtems which accommodate the Idea's of ſome prevailing Philoſopher to *Revelation*, or ſometimes even *Revelation* to his Idea's. He will not allow that either *Plato* or *Ariſtotle*, o *Deſcartes* himſelf, ſupport the Goſpel; He ſeem to be of Opinion, that all the Philoſophical Syſtems are no more than Modes, and that Eterna Truths muſt not be allied with the fleeting Fancies, the Ruin of which ought to be indifferen to a Chriſtian; that we ought to keep to the Majeſtick Simplicity of the Councils, which alway decide Divine Opinions, without intermixing an Humane Explanations. Such is the general Spir of the Work, at leaſt with reſpect to the Titl for Monſ. *Regis* blends with it a Theory of th Faculties of Man, of the *Underſtanding*, *Will*, & more largely than was abſolutely neceſſary. H even concludes it with a Treatiſe of the Love God; becauſe that Matter, which if Men pleaſe might be very plain and ſimple, was handled b great Doctors with much Subtilty; Laſtly, joyns to the whole Book a Refutation of the Sy ſtem of *Spinoſa*. He found himſelf obliged lay open its Obſcurities, which indeed were nece ſary to hide Error, but happily very unfit to

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duce Men. Here he finiſhed his learned Career; his Infirmities, that became more laſting and more painful, would not ſuffer him to labour any longer; the manner in which he ſupported them for ſeveral Years, was an inſtance of the moſt noble and moſt difficult Uſe that one can make of *Reaſon* and *Faith* both together. He died the 11th of *Jan.* 1707. at the Houſe of the Duke of *Rohan*, who had given him an Apartment in it; beſides the Penſion that he was obliged to pay him, purſuant to the Will of the Marquis *de Vardes*, his Father-in-Law.

He was choſe into the Academy in the Year 1699, upon the Re-eſtabliſhment thereof; but by reaſon of his Infirmities, he ſcarce performed any Academical Function, only his Name ſerved to adorn a Liſt in which the Publick would have been ſurpriſed not to have found him.

He had all his Life-time a large Correſpondence with People of the firſt Quality. The late Archbiſhop of *Paris* at the ſame time that he forbid him holding of Lectures, engaged him to come to his Houſe upon certain Days to diſcourſe with him about the ſame Matters; and perhaps it was a greater Honour to Monſ. *Regis*, that ſo Learned a Prelate ſhould ſubſtitute himſelf to the Publick. The late Prince who had a Genius for every thing, ſent often for him, and uſed to ſay, that he could not forbear believing what he explained ſo clearly.

His Reputation extended it ſelf into Foreign Countries, where it procured him Friends among the greateſt Perſonages, ſuch was the *Duke of Eſcalona*, a Grandee of *Spain*, and Viceroy of *Naples*. That Nobleman, more Curious and more affected with the Sciences than the reſt of his Nation are as yet, had conceived a ſingular Eſteem for him on occaſion of his general Syſtem, which he had carefully ſtudied; and when at the Battel of the *Ter* in the Year 1694, where he commanded the Spaniſh Army, his Equipage was taken by the Army of the Mareſchal *de Noailles*, he only deſired back again *Cæſar*'s Commentaries, and the Book of Monſieur *Regis*, which he kept in a little Trunk. The Count of *Sant Eſtevan de Gormas*, the Son of that Duke, coming into *France* in the Year 1706, waited upon this Philoſopher by Order of his Father; but after the firſt Viſit, it was no longer out of Obedience that he frequented his Company. The Duke of *Alva*, Ambaſſador of his Catholick Majeſty, did him the ſame Honour, at the Requeſt of the Viceroy of *Naples*.

The Manners of Monſieur *Regis* were ſuch, as the Study of Philoſophy might form, when it meets not with too much Reſiſtance on the ſide of Nature. The Opportunities that he had with reſpect to Fortune, were of as little uſe to him as they ought to be, and a great Eſteem, and a hearty Friendſhip, which the late Father *Ferrier*, the King's Confeſſor, had conceived for him at *Toulouſe* during his Lectures there, was of no more advantage to him, than only to procure him a moderate Penſion. Tho' he had been uſed to Teach, yet his Converſation was not the more imperious for it, but rather more eaſie and plain, having been accuſtomed to adapt himſelf to the Capacity of all his Hearers. His Learning did not render him Haughty to the Ignorant; and indeed the more learned a Man is, the greater

Complaiſance he has for ſuch Perſons, being thereby the more convinced that he ſtill reſembles them.

His Place of *Aſſociate Geometrician* was fill'd by Monſ. *Chevalier*, who before had been *Pupil* of the Abbot *Gallois*.

The LIFE *of the Mareſchal* de VAUBAN.

S*Ebaſtian le Preſtre*, *Chevalier* and *Seigneur de Vauban*, Mareſchal of *France*, Knight of the Orders of the King, Commiſſary-General of the Fortifications, Grand-Croix of the Order of St. *Lewis*, and Governour of the Citadel of *Liſle*, was born the 1ſt of *May*, 1633. His Father's Name was *Urban le Preſtre*, and his Mother's *Amy de Carmagnol*. He was of a good Family in the *Nivernois*, which had been in poſſeſſion of the Lordſhip of *Vauban* for above 250 Years.

His Father, who was but a younger Brother, and who moreover had ruined himſelf in the Service, left him no other Fortune than a good Education and a Muſquet. At the Age of 17 Years, that is to ſay in 1650, he enter'd into the Regiment of *Conde*, at which time that Prince was engaged in the *Spaniſh* Party.

The firſt fortified places he ſaw made him an Engineer, from the longing he had to become ſo. He applied himſelf diligently to the Study of Geometry, and principally of Trigonometry, and of Meaſuring or Surveying; and about the Year 1652, he was employ'd in the Fortifications of *Clermont* in *Lorain*. The ſame Year he ſerved at the Siege of *St. Menehout*, where he made ſome Lodgments, and ſwam over the River, the Enemy firing at him all the time; an Action that procured him a great many Praiſes and Careſſes from his Superiors.

In 1653, he was taken Priſoner by a Party of the *French*; and Cardinal *Mazarine* thought it worth the while even at that time to engage him in the Service of the King: But there was no need of taking much pains with a Man that was born the moſt faithful Subject in the World. In this ſame Year Monſ. *de Vauban* ſerv'd as Second Engineer under the Chevalier *de Clerville*, at the ſecond Siege of *Menehout*, which was re-taken by the King, and the Care of repairing the Fortifications of the place was committed to him.

In the following Years he performed the Function of Engineer at the Sieges of *Stenay*, *Clermont*, *Landrecy*, *Conde*, *St. Guillain* and *Valenciennes*. He was dangerouſly wounded at *Stenay* and *Valenciennes*, which ſcarce hinder'd him from continuing his Service. He receiv'd 3 Wounds at the Siege of *Montmedy* in 1657; and as the Gazette took notice of it, his Friends learnt from thence what was become of him; for in ſix Years time he neither return'd into his Country, nor writ to any one; ſo that this was the only way of communicating the News of himſelf. The Mareſchal *de la Ferté*, under whom he then ſerv'd, and who the Year before had made him a preſent of a Company in his Regiment, gave him one more in another Regiment, in the place of a Penſion; and then foretold aloud, that if the War ſpared him, he would attain to ſome of the higheſt Dignities.

In 1658, he had the chief Direction of the Attacks at the Sieges of *Gravelines*, *Ypres* and *Oudenard*. Cardinal *Mazarine*, who never uſed to gratifie People for nothing, gave him a handſome Reward, and accompanied it with Praiſes, which to a Man of Monſ. *Vauban*'s Temper, was of much greater value than the Gift it ſelf.

It is enough for us to have been thus particular in his firſt Beginnings, which were ſo much the more remarkable than all the reſt in an illuſtrious Life, as Virtue ſtript of all foreign Aſſiſtance, was the more put to its Shifts to make its own way. From hence forwards Monſ. *de Vauban* is well known, and his Hiſtory is interwoven with that of *France*.

After the *Pyrenëan* Treaty, he was employ'd either in demoliſhing, or in making fortified places.

He had already a great number of new Notions about the Art of Fortifications, which at that time was but little known: Thoſe who had practiſed it, or writ about it, had ſervilely tied themſelves down to certain Rules, eſtabliſh'd indeed, but very ill grounded, and to certain kinds of Superſtitions, which are always a long time predominant in every Profeſſion, and only vaniſh at the preſence of ſome ſuperior Genius. Beſides, they had either ſeen no Sieges at all, or not enough; ſo that their Methods of Fortifying were only calculated for certain particular Caſes that fell under their cognizance, but did not extend themſelves to the reſt. Monſieur *de Vauban* had already ſeen a great deal, and with good Eyes; he continually enlarg'd his Experience by reading all that was writ upon the Art of War; he felt in himſelf that which produces happy Novelties, or rather ſuch an Impulſe as forces the Production of them; in a word, he had the courage to declare himſelf an Inventer in ſuch a dangerous matter, and he continued ſo to the end. We ſhall not enter into the Detail of his Inventions, becauſe it would ſwell our Diſcourſe too much, beſides all the ſtrong places in the Kingdom may ſpare us that labour.

When the War broke out again in the Year 1667, he had the Conduct of all thoſe Sieges which the King made in Perſon, his Majeſty being willing to let the World ſee that it was an effect of his Prudence to ſecure in that manner the Succeſs of them. At the Siege of *Douay* he received a Muſquet-ſhot in his Cheek, of which he has ever ſince worn the Mark. After the Siege of *Liſle*, which he took, under the King's Directions, in nine Days, from the time of opening the Trenches, he received a conſiderable Gratification, much more neceſſary to ſatisfie the Inclination of the Maſter than that of the Servant. He has had a great many more upon different Occaſions, and always larger; but that we may the better enter into his Character, we ſhall ſay no more of this kind of Rewards, of which he was hardly ſenſible at all.

In 1668, he was taken up with projecting Fortifications for the places of the *Franche-Conté*, *Flanders* and *Artois.* The King gave him the Government of the Citadel of *Liſle*, which he had made, and this was the firſt Government of that nature in *France*. He did not ask it, and it is for the Glory of the King, as well as for his Honour, that the World ſhould know, that of all the Favours he ever receiv'd, he did not beg one, excepting ſuch as were not for himſelf. 'Tis true the number of theſe latter were ſo great, that they almoſt exhauſted the Right he had to ask them.

The Peace of *Aix la Chapelle* being made, his Employment did not become the leſs for it: He fortified ſeveral places in *Flanders*, *Artois*, *Provence* and *Rouſſillon*, or at leaſt made Plans of them, which have ſince been put in execution. Afterwards he went into *Piedmont* with Monſ. *de Louvois*, and communicated to the Duke of *Savoy* Plans for the Fortification of *Verue*, *Verceil*, and *Turin*. At his Departure his Royal Highneſs beſtowed upon him his Picture ſet with Diamonds. He is the only Military Man to whom Peace has always been as laborious as the War it ſelf.

Altho' he was not obliged by his Employment to take care of any thing more than the Security of the Frontiers, yet his Love for his Country made him apply himſelf to find out Means for increaſing the Happineſs thereof. In all his Travels he had the Curioſity, which thoſe who are in Offices are uſually but too much exempted from: He carefully inform'd himſelf of the Value of the Lands, of their Productions, of the manner of Cultivating them, of the Riches and Number of the Peaſants, of the accuſtomary Food, and what their Labour might amount to one Day with another; Circumſtances mean and contemptible in appearance, but which neceſſarily belong to the great Art of Government; then he ſet himſelf to conſider of Methods to improve a Country, of the High-ways, of Bridges, of making Rivers navigable, *&c.* Projects, of which it was not poſſible for him to expect an entire Execution, and therefore might in ſome ſenſe be counted Dreams, but at leaſt ſuch as like real Dreams diſcover'd the Predominant Inclination of the Man. There are ſome Intendants or Governours of Provinces with whom he had not the leaſt Acquaintance; notwithſtanding which, he ſent them Letters of Thanks for ſome New and profitable Eſtabliſhment, which he had obſerved in their Diſtricts; thus he became the particular Debtor to every one that had obliged the Publick.

The War which began in 1672, furniſhed him with a vaſt number of glorious Opportunities, particularly in the many Sieges made by the King in Perſon, and of all which Monſ. *Vauban* had the Direction. 'Twas at that of *Maeſtricht* in the following Year, that he began to make uſe of a new Method, which he had invented by a long Series of Reflections, and which he has ever ſince practiſed in the Attack of Places. 'Till then he had only followed, but with more Skill and Management, the Rules already laid down, but then he followed unknown ones, whereby he changed the face of this important Branch of making War. The famous Parallels and Places of Arms firſt appeared here; ſince when he has been always improving this Subject, one while by *Cavaliers de Tranchée*, another time by a new uſe of Saps and Demi-ſaps, then by Batteries *en ricochet*, by which means he brought his Art to ſuch a Perfection, that often-times he loſt no more People before the ſtrongeſt places than the Beſieged themſelves; a Thing which one could never have expected. Indeed the Preſervation of his Men was his chiefeſt Care, not only the Intereſt of War, but even his own Natural Humanity and Goodneſs made them dear to him. 'Twas to this Conſideration that he always ſacrificed the Splendour of a ſpeedy Conqueſt, and a Glory ſufficiently capable of ſeducing a Man; and what was yet more difficult, he ſometimes reſiſted, for the ſake of his Men, the Impatience and Uneaſineſs of the Generals, and expoſed himſelf to the Formidable Cenſures of the Lazy Courtiers. This made the Soldiers obey him with an implicit Devotion, being yet leſs encouraged by the entire Confidence they had of his Capacity, than by the Aſſurance, and Gratitude for being ſpared as much as poſſible.

During that whole War which was determined by the Peace of *Nimeguen*, his Life was one continual and vigorous Action, employed in Projecting Sieges, Directing thoſe that were formed, at leaſt the moſt Important ones, Repairing places that were taken, and making them Stronger; Viſiting all the Frontiers; Fortifying whatever might be expoſed to the Enemy, paſſing from one Army to another, and oftentimes from one End of the Kingdom to the other.

He was made Brigadier of the Foot in 1674, Mareſchal de Camp in 1676, and Commiſſary-General of the Fortifications of *France* in 1678; which laſt Office became then vacant by the Death of the Chevalier *Clerville*. He declined taking it at firſt, fearing that which would have render'd it more deſirable to another, the great Relation that it gave him to the Miniſtry; but the King made uſe of his Authority to oblige him to accept of it; but it muſt be confeſſed, that notwithſtanding all his Integrity, he had no reaſon to Repent of it. Virtue does not fail to ſucceed ſometimes, but it is only by length of Time, and by the weight of many Trials.

The Peace of *Nimeguen* deprived him of the troubleſome Employment of taking Places, but in ſtead of that, it afforded him a much greater number to be fortified. He made the famous Port of *Dunkirk*, and it was his Maſter-piece. *Strasburg* and *Caſal*, that fell into the King's hands in 1681, were after that his moſt conſiderable Buſineſs. Beſides the vaſt and magnificent Fortifications of *Strasburg*, he made the little River *Bruche* Navigable by Sluices; the Execution of which was ſo difficult, that he durſt not truſt it to any body, but always ſuperviſed himſelf.

The War broke out again in 1683, and gave him the Honour of taking *Luxembourg* in the following Year, which 'till then was thought Impregnable; but he took it with very little Loſs. But the dawning War having been ſtifled by the Truce of 1684, he reſumed his Functions of Peace, the moſt ſhining of which were the *Aqueduct* of *Maintenon*, the New Works that compleated the Canal for the Communication of the two Seas, and thoſe of *Mont-Royal* and *Landau*.

One would think that the Secrets of his Art muſt have been diſcover'd by the great Number of Works that came out of his Hands: And ſo indeed there did appear a Book, the Title of which promiſed the true Method of Fortifying according to Monſieur *Vauban*; but he always affirmed, and has ſhewn it by his Practice, that he had no *One* Method at all. Every different Place furniſhed him with a new Manner; according to the different Circumſtances of its Bigneſs, Situation and Soil. The moſt difficult of all the Arts are thoſe whoſe Objects are always variable, and which cannot endure the convenient Application of certain fixed Rules by Men of a narrow Genius, but every Moment require Natural and Extempore Expedients, which can only flow from great Souls.

The War being re-kindled in 1688, he directed the Sieges of *Philipsbourg*, *Manheim* and *Frankendal*, under the Command of the *Dauphin*; and that great Prince was ſo well pleaſed with his Services, that he gave him the Choice of four Pieces of Cannon for his Caſtle of *Bazoche*; a true Military Recompence, and a Singular Privilege, which could ſo juſtly belong to none elſe but to the Father of ſo many ſtrong Places. The ſame Year he was made Lieutenant-General; and the next Year he Commanded at *Dunkirk*, *Bergues*, and *Ypres*.

The Year 1690, was a very Singular one among all thoſe of his Life, for he hardly did any thing in it, having contracted a great and dangerous Illneſs whilſt he was labouring in the Fortifications of *Ypres*, which were very much out of Order, ſo that he was obliged to be always preſent at the Works; but this Inaction, which he could ſcarce forbear reproaching himſelf with, determined in 1691, by the taking of *Mons*, at the Siege whereof the King commanded in Perſon; as His Majeſty did the following Year at that of *Namur*, and Monſ. *de Vauban* had the Direction of it, and took it in 30 Days after opening the Trenches, with the loſs only of 800 Men, tho' there had paſs'd five very vigorous Actions.

We muſt omit a great number of leſſer Exploits, ſuch as the Siege of *Charleroy* in 1693; the Defence of the Lower *Britany* againſt the Deſcent of the Enemies in 1694 and 1695; the Siege of *Aeth* in 1697, and make haſt to thoſe things that more nearly concern the Academy. When that Body was revived in the Year 1699, they beſought his Majeſty to make Monſieur *de Vauban* one of their Honorary Members; and if Decency would allow us to ſay that a Place in that Body may be accounted a Reward for Merit, after all thoſe he had received from the King in the Quality of a Military Man, it was neceſſary he ſhould receive one from a Society of Learned Perſons in the Quality of a *Mathematician.* No body had more effectually than he brought down from Heaven the Science of the Mathematicks, to employ them in the Wants of Mankind, and they had receiv'd from his hands an Uſefulneſs as glorious, perhaps, as their greateſt Sublimity. Beſides, the Academy owed him a particular Acknowledgment for the Eſteem he had always ſhewn to them; the ſolid Advantages which the Publick may one day reap from our Eſtabliſhment, had touched him in the moſt ſenſible part of his Soul.

As after the Peace of *Ryſwick*, he was only employ'd in viſiting the Frontiers, in making the Tour of the Kingdom, and in forming new Projects; he found that he ſtill wanted ſome more Buſineſs, and he embark'd himſelf in one that was according to his own Heart. He began it, by reducing into Writing a prodigious number of Notions that he gather'd together upon the different Subjects which relate to the Good of the Commonwealth: Not only upon thoſe that were moſt familiar to him, ſuch as the Fortifications, and other Circumſtances of Places, Military Diſcipline, Campings, *&c.* but likewiſe upon an Infinity of other Matters which one would have imagined to have been much more out of his Way, ſuch as relate to the Sea, to the Privateering in Time of War, to the Cuſtoms and Taxes, to the Improvement of Foreſts, Trade and the French Colonies in *America.* A great Soul thinks of every thing. From all theſe different Idea's he compoſed 12 great Manuſcript Volumes, which he calls *Idle Hours*; but if it were poſſible that all his Projects could be put in execution, his *Idle Hours* would be much more uſeful than all his *Labours.*

The Succeſſion to the Crown of *Spain*, having renewed the War, he was ſent to *Namur* in the beginning of the Year 1703, and gave Orders for the neceſſary Reparations of that Place; it was then that the King had honour'd him with the Title of Mareſchal of *France*, which he himſelf had oppoſed before, when his Majeſty had ſignified to him his Intentions of raiſing him to this higheſt Degree of Military Honour; having repreſented that it might hinder his being employed with Generals of the ſame Rank, and occaſion ſome Inconveniencies in the Publick Service. His Ambition was to become more Uſeful, and leſs Rewarded; and if it had been according to his own Mind, the only Recompence of his paſt Services, would be to employ him in ſuch as were yet more neceſſary.

About the end of the ſame Year he ſerved under the Duke of *Burgundy* at the Siege of Old

Briſac, a very conſiderable Place, but which he obliged to Capitulate at the end of thirteen Days and a half after the Trenches were open'd, and at the expence of 300 Men only. This Siege was his laſt Labour, and here he ſhew'd all that his Art could do; as if he had a Mind to reſign it whole and entire into the Hands of that Prince, who was both his Spectator and Commander.

The Title of Mareſchal of *France* did produce the Inconveniencies which he had foreſeen, and made him live uſeleſs two Years together. I have often heard him lament it, proteſting that for the Sake of his King and Country he could have trampled under his Foot that Dignity with pleaſure; and he would have done it too, if he might; this was the beſt Way of meriting it, the beſt Way of ſupporting the true Luſtre of it.

He comforted himſelf however with his learned Idleneſs, ſparing no Expence in Collecting a vaſt number of ſuch Memoirs and Inſtructions as he wanted, and employing continually a great many Clerks, Limners, or Deſigners, and Arithmeticians.

He gave the King, in the Year 1704, a great Manuſcript which contained the moſt valuable and ſecret Rules for managing Sieges, the moſt noble Preſent that a Subject could ever make his Maſter, and which the Maſter could only receive from ſuch a Subject.

In 1706, after the Battel of *Ramelies*, the Mareſchal *de Vauban* was ſent to Command at *Dunkirk*, and all along the Coaſt of *Flanders*, where his Preſence did ſo much encourage the dejected People, that he ſaved the Loſs of a Country which they were going to drown, to prevent the Siege of *Dunkirk*, which he likewiſe ſaved by a retrenched Encampment he made between that Town and *Bergues*, ſo that the Enemy would have been obliged to have inveſted at the ſame time *Dunkirk*, *Bergues* and his Camp; a thing wholly impracticable.

In this ſame Campaign, ſeveral of our Places not having defended themſelves ſo well as he could have wiſhed, he reſolved to defend by his Advice all thoſe that might be attacked for the Future. Upon this Occaſion he began a Work that he deſigned for the King, but did not live to finiſh it quite, for he died the 30th of *March* 1707, of a great Defluxion upon his Breaſt, attended with a violent Fever, which carried him off in eight Days time, tho' he was of ſo Robuſt a Conſtitution that he ſeemed likely to live ſeveral Years longer. He was 74 Years old within a Month.

He married *Jane Danois*, of the Family of the Barons of *Eſpiri* in the *Nivervois*; ſhe died before him, leaving two Daughters, the Counteſs of *Villebertin* and the Marchioneſs of *Uſſé*.

If you would ſee his whole Military Life in Miniture, take it thus: *He Fortified Three hundred Old Places, and made Thirty three quite New; He Directed Fifty three Sieges, Thirty of which were made under the Command of the King in Perſon, or of the Duke of* Orleans, *or of the Duke of* Burgundy; *and the other Twenty three under different Generals: He was preſent at* 140 *Engagements.*

Never were the Traces or Features of a plain and ſimple Nature more remarkable in any Man than in him, nor more free from any Foreign Mixture. An enlarged and upright Mind, which embraced Truth by a Kind of Sympathy, and diſcovered Falſhood without any Diſcuſſion, ſaved him thoſe long Deviations that others were forced to make; and beſides, his Nature was in ſome ſort a happy Inſtinct, and always ſo much at hand, that it got the ſtart of his Reaſon. He deſpiſed that ſuperficial Politeneſs with which the World is generally contented, tho' it often conceals a great deal of Roughneſs; but his Goodneſs, Humanity and Generoſity, were the Ingredients of a more uncommon Politeneſs, and which reſided altogether in his Heart. It well enough became ſo many Virtues to neglect an out-ſide, which indeed does naturally belong to them, but which Vice does too often and too eaſily aſſume.

The Mareſchal *de Vauban* did often aſſiſt with conſiderable Sums of Money ſeveral Officers that were not in a Condition to ſupport the Service; and when it was known, he ſaid his Deſign was only to reſtore the Overplus of the too great Favours that he had received from the King, and that were heaped upon him during the Courſe of a long Life; notwithſtanding which, he had the Glory to die with a moderate Eſtate. He was paſſionately addicted to the Service of the King, being a Subject of a moſt ſincere and zealous Fidelity, but nothing of a Courtier: He was much more deſirous of Serving than of Pleaſing: No body was more often, nor with more Courage than he, the Aſſertor and Champion of Truth, for which he had a Paſſion even to Indiſcretion, and uncapable of Government. His Morals always held good againſt the moſt ſhining Dignities, and even without a Combat. In a word, he was a *Roman* whom our Age ſeemed to have Stoln from the moſt happy Ages of that great Commonwealth.

His Place of Honorary Academiſt was filled by the Mareſchal *D'Eſtrées*, Vice-Admiral of *France*, Grandee of *Spain*, Chevalier of the Orders of the King, and Governour of the *Nantois*.

The LIFE *of the Abbot* GALLOIS.

JOhn *Gallois* was born at *Paris* the 14th of *June* 1632. of *Ambroſe Gallois*, Advocate in Parliament, and of *Frances de Launai*.

His Inclination for Learning appeared as early as he could ſhew an Inclination for any thing, and always increaſed with his Years; he applied himſelf to the Study of Divinity, and was admitted into the Order of the Prieſthood.

Thus his Duty turned his Principal Studies to Eccleſiaſtical Hiſtory, the Writings of the Fathers and the Holy Scriptures, and he extended them even to the Oriental Languages, neceſſary at leaſt to thoſe that would aſcend to the firſt Springs of Divinity; but he did not renounce Prophane Hiſtory, nor the Living Languages; ſuch as the *Italian*, *Spaniſh*, *Engliſh* and *High Dutch*; nor the Mathematicks nor Natural Philoſophy, nor even Phyſick it ſelf: For his Zeal for Knowledge embraced every thing, and if it be true that a Learning ſo divided does leſs qualify a Man for a particular Reputation, it is at leaſt much more proper to enlarge the Mind in all Senſes, and to enlighten it on all Sides.

Beſides the Knowledge of thoſe Things that Books contain, Abbot *Gallois* had moreover acquired that of Books themſelves, a Science almoſt diſtinct from the other, tho' it be the Conſequence of them, and is produced by a lively Curioſity which neglects no Part of its Object.

The firſt Work which the Publick ſaw of this Gentleman, was a Latin Tranſlation of the *Pyreněan* Treaty, printed by Order of the King; but his Name ſoon became more Illuſtrious by his publiſhing the *Journal des Sçavans.* 'Twas in the Year 1665, that this Work firſt appeared, the Idea of which was ſo new and ſo happy, that it ſubſiſts even to this Day with more Vigour than ever, and has produced a numerous Iſſue ſcatter'd throughout all *Europe*, under the different Names of *Nouvelles de la Republique des Lettres. Hiſtoire des Ouvrages des Sçavans. Bibliotheque Univerſelle. Bibliotheque Choiſie. Acta Eruditorum. Tranſactions Philoſophiques. Memoires pour l'Hiſtoire des Sciences & des beaux Arts*, &c. Monſ. *de Salle*, an Eccleſiaſtical Councellor in Parliament, firſt projected the Deſign of it, and joined the Abbot *Gallois* with him; who, by the great variety of his Learning ſeemed to be Born for this Employment, and who beſides (which is not common with thoſe that know every thing) underſtood *French* and writ it well.

This Journal from its Birth aſſumed a great Authority to it ſelf, and cenſured too freely moſt of the Writings that appeared. The Commonwealth of Learning which found its Liberty ſtruck at, took up Arms, and damned the Journal at the end of three Months. But as the Project was Excellent in it ſelf, the World would not ſuffer it to be quite loſt, and Monſ. *de Salle* giving it up entirely to the Abbot *Gallois*, he open'd the Year 1666, with a new Journal, which he dedicated to the King and put his Name to it; in which he ever after exerciſed the Juriſdiction he was poſſeſs'd of with all becoming Moderation.

Monſ. *Colbert*, affected with the Uſefulneſs and Beauty of this Journal, took a Fancy to the Work firſt; and ſoon after to its Author. In 1662, he gave him a Place in the New-born *Academy*, with the Office of Secretary in the Abſence of Monſ. *du Hamel*, who was two Years out of the Kingdom. The Abbot *Gallois* enriched his Journal with the principal Diſcoveries of the *Academy*, which at that time were ſcarce otherwiſe made known to the Publick than by that Means, and he moreover frequently gave an Account of it to Monſ. *Colbert* by word of Mouth, preſenting him with the Fruits of that Protection which he had granted to the Sciences. After which, that Miniſter being more and more pleaſed with his Converſation, always ſent for him when he came to *Paris*; His Curioſity upon what Subject ſoever found him ready to ſatisfie him, and if a more exact and profound Diſcuſſion were neceſſary, no body could diſpatch it in ſo ſhort a Time as the Abbot *Gallois*, a Circumſtance almoſt always neceſſary to Monſ.

Colbert;

Colbert. Finally, this Miniſter who knew Men well, after having had a long trial both of the Wit, Learning and Manners of Monſ. *Gallois*, took him to himſelf in 1673, and gave him always a Place both at the Table and in his Coach. So ſingular a Favour as this, was at the ſame time both a glorious Recompence of his Learning, and a continual Occaſion to make an agreeable uſe of it, and a happy Neceſſity of improving it every Day.

Monſ. *Colbert* favour'd Learning not only out of a natural Inclination, but of a wiſe Policy too. He knew that the Arts and Sciences were alone ſufficient to make a Reign Glorious, that they extended the Language of a Nation perhaps beyond Conqueſts, that they beſtow upon it the Empire of the Mind and of Induſtry equally pleaſant and uſeful, that they attract a great number of Strangers, who enrich it by their Curioſity, fall into its Inclinations, and cleave to its Intereſts. During ſeveral Ages, the Univerſity of *Paris* did not leſs contribute to the Greatneſs of that Capital than the Reſidence of its Kings. To Monſ. *Colbert* is owing the Splendour in which Learning finds it ſelf at preſent, the Birth of the ſeveral Academies of *Sciences*, *Inſcriptions*, *Painting*, *Sculpture* and *Architecture*, the new Favours which our Society has received from the King, the Impreſſion of a great Number of excellent Books, at the King's Charge in the Royal Printing-Houſe, the almoſt immenſe Increaſe of the Royal Library, or rather of the Publick Treaſure of the Learned, an Infinity of Works which the great Authors, or able Mechaniſts do only grant to the Careſſes of Princes and their Miniſters, and laſtly, a Taſt of every thing that is great and fine, diffuſing it ſelf on all Hands, and continually increaſing. The Abbot *Gallois* had the ſenſible Pleaſure of viewing more nearly ſuch a Miniſter, of being at the Fountain-head of thoſe noble Deſigns which he formed, of ſharing in their Execution, and ſometimes even the Glory of ſuggeſting them, and of ſeeing them followed. The Men of Learning had in him a Sollicitor near the Prime Miniſter, and always inſtructed in their Affairs, tho' for the moſt part, they had not ſo much as the trouble of Recommending them to his Care. If any New Book, or any Diſcovery and Invention of an Author whom he did not ſo much as know, appeared in Publick with Reputation, he took care to inform Mr. *Colbert* of them, and the Recompence was ſeldom far off. The King's Bounty extended it ſelf even to the Merits of Foreigners, and ſought ſometimes as far as the moſt Northern Countries for a Learned Man that was ſurpriſed to be found.

In 1672, the Abbot *Gallois* was received into the *French Academy*. Tho' Eloquence or Poetry are the principal Talents which that Society requires, yet ſhe admits likewiſe of Erudition that is not Barbarous, and perhaps there is nothing elſe wanting to her, but to adorn her ſelf a little more with the uſe ſhe makes, and even with the occaſion ſhe has for it. In 1674, Monſ. *Gallois* left off writing the Journal, and put it into other Hands. He was too much employed at Monſ. *Colberts*, and beſides that Work was too ſlaviſh for a Genius naturally ſo free as his; he could not reſiſt the Charms of a new Book, which call'd him away, nor of a ſudden Curioſity that ſeiz'd upon him, ſo that he was forced to ſacrifice the Regularity required in writing a Journal to his new Paſſion.

The Commonwealth of Learning ſuffer'd a very great Loſs by the Death of its Patron Monſieur *Colbert*, in the Year 1683. He had added to the Glory of having render'd it great Services, that of having done almoſt nothing for himſelf. Monſieur *Gallois* had only a moderate Penſion from the Academy of Sciences, and an Abbey of ſo ſmall an Income, that he did not think it worth the keeping. The late Marquis *Seignelai*, Son of Monſ. *Colbert*, gave him the Place of Keeper of the King's Library, which was then in his Diſpoſal; but it being out of his Hands afterwards, the ſaid Marquis made him amends with the Office of *Greek* Profeſſor in the Royal College, and with a particular Penſion, which he obtained of the King for him, upon the Revenue of that College, and next to a kind of general Inſpection. Monſieur *de Seignelai* did not think that his Father had done enough for him, and ſince the Frugality of Monſ. *Colbert* is not to be charged upon his want of love for Learning, the little care he took of the Abbot *Gallois* muſt be placed to the account of that Gentleman's Moderation.

When under the Miniſtry of Monſieur *Pontchartrain*, at preſent Chancellor of *France*, the Academy of Sciences began, by the care of the Abbot *Bignon*, to recover it ſelf out of the Languiſhment into which it had fallen; 'twas Monſieur *Gallois* that put in order the Memoirs of the *Academy*, which appear'd in 1692 and 1693; and whoſe care it was to poliſh the Stile of them: But the great variety of his Studies did ſometimes interrupt this Work, which was tied down to certain Times; ſo that he was oblig'd at laſt to quit it wholly. The *Academy* having taken a new Form in the Year 1699, he filled the Place of a Geometrician in it, and took for his Province the Geometry of the Ancients, and principally the Collection of *Pappus*; the *Greek* Text whereof having never been publiſh'd, he deſign'd to print, and to correct the *Latin* Tranſlation which was very defective. Nothing was more agreeable to his Inclinations, and to his Talents alſo, than a Project which required the Love of Antiquity, a profound Skill in *Greek*, and Knowledge of the Mathematicks; and it was a Misfortune to Learning that this was no more than a Project. *One of the moſt pleaſing Hiſtories, and, without doubt, moſt Philoſophical too, is that of the Progreſs of Humane Minds.*

The ſame Taſt for Antiquity which had tempted Monſ. *Gallois* to this Undertaking, a Taſt ſo hard to be contain'd within juſt Bounds, made him not very favourable to the *Geometry* of the *Infinites*, eſpouſed by all the Moderns. We cannot even diſſemble it, becauſe our Hiſtories have declared it, that he openly attack'd this new Geometry. In general he was no Friend to Novelty, and beſides he oppoſed, out of a Spirit of *Oſtraciſm*, every thing that made too great a Figure in a Free State, ſuch as that of Learning: The *Geometry* of the *Infinite* had thoſe two Faults, eſpecially the latter; for to ſpeak the truth, it cannot be eſteem'd entirely novel; and the zealous Partiſans of Antiquity would much better find their Account in maintaining that the ancient Geometricians knew and practiſed the firſt Foundations of it, rather than to oppoſe it upon the Suppoſition that it was unknown to them.

As all the Objections made againſt the *Infinitely Littles* had been follow'd by a demonſtrative Solution, the Abbot *Gallois* began to offer ſome, under the Pretext of clearing his Doubts; and perhaps the different Reſources which his Genius might have furniſh'd him withal, would not have been ſo ſoon exhauſted, if from a perfect and vigorous Health he then enjoy'd, he had not fall'n at once into a Diſtemper, whereof he died the 19th of *April*, 1707.

He was of a lively, ſtirring and jovial Temper, a bold Genius, very fertile in Expedients whenever he wanted them, and capable of carrying him a great way out of a ſenſe of Honour. He had no other Employment than Books, nor no other expenſive Pleaſures than that of buying them. He had gather'd together above 12000 Volumes, and was daily adding to them. If ſo numerous a Library can be uſeful, it was to a Man of his vaſt Learning, whoſe Curioſity hurried him to a thouſand different Objects, and it muſt be contented upon the ſpot. His Morals, and eſpecially his Diſintereſtedneſs, ſhined throughout his whole Life whilſt he was with Monſieur *Colbert*. Chriſtian Charity gave that Natural Diſintereſtedneſs its utmoſt Perfection; he only reſerved to himſelf, out of the Abbey of *St. Martin de Cores*, a Penſion of 600 Livres, and left 'em to his Succeſſor, to to be diſtributed among the Poor of the Country. His place of *Penſioner Geometrician* was filled by Monſieur *Saurin*.

The LIFE of Monſieur DODART.

DEnis Dodart, Phyſician to the King, to the Princeſs Dowager of *Conti*, and to the preſent Prince, Regent Doctor in the Faculty of Phyſick at *Paris*, was born in 1634, of *John Dodart* Citizen of *Paris*, and of *Mary Dubois*, Daughter of a Lawyer. *John Dodart*, tho' he was unlearned, had a great deal of Senſe, and that which is moſt valuable, of good Senſe. He had even made a good Collection of Books, and enough for a Man who was not expected to know any thing. *Mary Dubois* was a Woman that diſtinguiſhed herſelf by a very agreeable Temper, and by a Heart much above her Fortune. The reaſon why we make this little Picture of the Father and Mother, is becauſe of the relation it may bear to that of the Son. It is but juſt that we ſhould place to their Account, and do honour to their Memory, for the ſhare which they had in his natural Merit.

They were not contented to Inſtruct their Son in Latin and Greek, but they joyned to it Painting, Muſick, and ſuch like Exerciſes which are only the Ingredients of the moſt chargeable Education, and which are but too much conſider'd as agreeable Superfluities. He ſucceeded in them all, ſo as to give the greateſt hopes of himſelf, and finiſhed his Studies ſo early that he had leiſure enough to apply himſelf equally to Law and Phyſick, that he might the better determine himſelf which Profeſſion he would ſtick to. He is perhaps the only Man that would chuſe with ſo much *Cogniſance of Cauſe*; 'Tis true indeed that he did at the ſame time ſatisfie his own great Thirſt after Knowledge.

He declared at laſt for Phyſick, his natural Inclination byaſſing him that way; but that which determined him yet more powerfully was, that he ſaw in it no Danger in reſpect to *Juſtice*, but infinite Occaſions for exerting *Charity*; for he was even then affected with the ſame Sentiments of Religion, that remained in him all the reſt of his Life.

It is eaſie to imagine with what Ardour and Perſeverance a Man of Underſtanding applies himſelf to a Study, when it becomes his eſſential Duty. He diſtinguiſhed himſelf very much as he went thro' his Courſes of Phyſick, and we have authentick Proofs thereof, as well as of his Character in his earlieſt Youth. *Guy Patin* in his 186th Letter of the Edition of 1692, ſpeaks thus of him: " This day the 5th of *July*, 1660, we have Li-" cenſed our Old Batchelors; there is Seven of " 'em in Number, of whom the ſecond, named " *Dodart*, aged 25 Years, is one of the wiſeſt " and moſt knowing Men of this Age. This " Young Man is a Prodigy of Wiſdom and of " Learning, *Monſtrum ſine Vitio*, as *Adrian Tur-" nebus* ſaid of *Joſeph Scaliger*". Afterwards, in his 190th Letter, he ſpeaks further of him thus: " Our learned Licentiate is named *Dodart*, Son " of a very honeſt Man and Citizen of *Paris*. " 'Tis a great Lad, very Wiſe and very Modeſt; " he knows *Hippocrates*, *Galen*, *Ariſtotle*, *Cicero*, " *Seneca*, and *Turnel*, by heart. He is an admi-

" rable Fellow, and is not yet 26 Years old; for " the Faculty at the firſt Examination of him " gave him his Grace for ſome Months, which " were wanting to qualifie him for his Degree, " out of the good Opinion that they had con" ceived of him before-hand". All theſe Circumſtances of the Account Mr. *Patin* gives of him, are worthy our Attention. He was a Phyſician himſelf, and a very Learned one, paſſionate for the Glory of Phyſick; and the Letter, in which he mentions Monſ. *Dodart*, was writ to one of his Friends with a Freedom even to exceſs; Panegyrick is not very common in his Letters, in which the Gall of an independant Philoſopher did moſtly predominate; there was neither Kindred nor Friendſhip between him and Monſ. *Dodart*, nor was he at all concerned for him; he took no notice of any other young Students; in a word, he was no Bigot, ſo that an air of Religion muſt be very ſincere, to make it ſelf amiable in his Eyes. If Self-love were a little more nice, nothing would be accounted Praiſe without the like Qualifications. Monſ. *Patin*, in his 207th, 208th, and 209th Letters, continues to give his Friend an account of Monſ. *Dodart*. Sometimes he calls him, *our Licentiate ſo Wiſe and ſo Knowing*, and ſometimes *our Learned young Doctor*: He always keeps him in ſight, only by a ſimple Curioſity, which was ſo much the greater Compliment as it was altogether Indifferent.

Men of the moſt oppoſite Sentiments joyned in the Commendation of Monſ. *Dodart*. *Father Deſchamps*, of a Society that was not much eſteemed by Monſ. *Patin*, having heard by chance the young

Doctor reading a Lecture in the Phyſick Schools, was ſo touch'd with the Purity of his *Latin*, that upon the account he gave of it to Monſ. *de Brienne*, at that time Secretary of State for Foreign Affairs, that Miniſter began to caſt his Eyes upon him, and having inform'd himſelf farther about him, he had a great deſire to engage him in his Service as Firſt Clerk under him. The Beginnings of thoſe Men who have nothing but their own Merit to introduce them into the World, are generally obſcure and ſlow enough; and the Eſtabliſhment of Monſ. *Dodart* was at that time very moderate, and yet nether a conſiderable Fortune that threw it ſelf in his way, nor the tempting ſplendour of a Place at Court, could make him renounce his firſt Choice. His Conſtancy was ſupported by more noble Principles, which perſwaded him that Heaven had deſtined him for the Place he was in. Monſ. *Brienne*, to engage him inſenſibly, deſired only of him that he would write ſome of his moſt important Letters, and he obliged him in it, but cautiouſly avoided that Snare, which another Man would have cheerfully run into.

His Attachment to his Profeſſion had its Reward. He became quickly known, and the Dutcheſs of *Longueville* took him for her Phyſician. She was at that Time famous for that great Piety which only ended with her Life; ſhe had a great Eſteem for Men of Senſe, and not only for that kind of Senſe which diſtinguiſhes a Man in one certain Way, but chiefly for that which a Man may carry every where a long with him. She was too much accuſtomed to it, to be able to live without it, and any other Language would have been too great a Stranger to her. A good Phyſician, but without this ſort of Senſe, or a great Fund of Piety, would not have been agreeable to her. She therefore ſoon honoured Monſ. *Dodart* by the Truſt ſhe put in him; I mean, ſuch as one conceives for a true Friend, of which the great inequality of their Conditions gave him all but the Name.

The late Dowager Princeſs of *Conti*, Mother to the two Princes of *Conti* and *de la Roche-Sur-Yon*, was deſirous of ſharing Monſ. *Dodart* with Madam de *Longueville*; and as ſhe beſtowed upon him the ſame Title, ſhe gave him that which in reſpect to him was inſeparable from it; the ſame Confidence, and the ſame Familiarity: But which is yet, if it were well conſider'd, more Glorious for him, than even the Friendſhip of theſe two Great and Virtuous Princeſſes, he was beloved by all thoſe that were about them. One need not be acquainted with many Families of great Men, to know, that to be well with all the World, is a Maſter-piece of Conduct and Wiſdom, and oftentimes the more difficult, by how much one has other great and bright Qualities. The true Secret for ſucceeding therein, was that which he always practiſed; he obliged every one as much as was poſſible, and ſpared not his Intereſt in ſerving others. To want his Credit, and to have a Right to uſe it, was with him one and the ſame thing, which was happy for a great Number of deſerving Men: The two Places he was poſſeſt of, made him known to a great many other Perſons of the firſt Quality, or in the higheſt Stations. And I am not afraid to ſay, that notwithſtanding they were ſo much above him, they conceived for him that kind of Reſpect, which was not eſtabliſh'd by Men, and whereof Nature has reſerved to her ſelf the Right of diſpoſing, in favour of Virtue.

After the Death of the old Princeſs of *Conti*, he attached himſelf to the two Princeſſes her Children; and after the Death of the Eldeſt, to the Princeſs of *Conti* his Widow, and to the Young Prince their Son; nothing can exceed the Zeal, Fidelity and Diſintereſtedneſs which he carried with him into their Services; but one cannot determine whether ſuch Patrons did not render thoſe fine Qualties more perfect than naturally they would have been. He had the good luck to ſucceed in the dangerous Diſtempers with which the Princeſs was viſited, and that alſo of pleaſing the Prince of *Conti* by the ſolid Charms of his Converſation. Every one knows how great a Man that Prince is, and how good a Judge of others.

In 1673, Monſ. *Dodart* came into the *Academy* of *Sciences*, by the means of Monſ. *Perraut*. Thoſe Gentlemen had great Credit with Monſ. *Colbert*, and made an extraordinary Uſe of it, which was to make known to that Miniſter, and to procure his Favour for thoſe that had great Talents, as well as they themſelves.

The Academy had already undertaken the Hiſtory of *France*, a Work of a vaſt extent, and Monſ. *Dodart* took the labouring Oar upon himſelf. At the end of three Years, that is to ſay in 1676, he placed at the Head of a Volume (which the Academy printed under the Title of *Memoirs to ſerve for the Hiſtory of France*) a Preface, in which he gave an account, both of the Deſign it ſelf, and of what had been done therein to that Time. We have not any other Work of his in Print, and by good luck, the Matter of it has given him an opportunity perfectly to paint in it his own Character. A long Enquiry, and a nice Diſcuſſion, were abſolutely neceſſary in ſuch a Work; and he poſſeſſed in a ſovereign Degree the Spirit both of *Diſcuſſion* and *Enquiry.* He knew on which ſide, or rather upon how may different ſides he was to extend his View, and as one may ſay, to direct a Teleſcope. Every one knows not how to ſee, and we often take for an entire Object the firſt Face which Chance preſents us with; but Monſ. *Dodart* had the Patience to ſeek for all the reſt, and the Art to diſcover them, or at leaſt the Precaution of ſuſpecting thoſe which he could not diſcover. 'Tis not only the greateſt Objects which have ſeveral Faces, the very ſmalleſt have them alſo; and a ſtrict Attention is a kind of a Microſcope, which ſerves to magnifie them. 'Tis true indeed, that this kind of ſcrupulous Attention, which never believes it has view'd a thing ſufficiently, this care of turning an Object every way, in a Word, this Spirit of *Diſcuſſion* is very contrary to that of *Deciſion*; but it is more the Buſineſs of the *Academy* to Examine than to Decide, diligently to trace Nature by exact Obſervations, and not to prevent her by raſh Judgments.

Nothing better becomes our Reaſon, than that her Concluſions ſhould be a little timerous, and even when ſhe has a right to Decide, ſhe would do well to abate ſomething of it: One may take the Preface that we have now quoted for a Pattern of a Theory embraced in its utmoſt extent, traced even to its leaſt

Dependencies, very nicely diſcuſſed and ſeaſoned with a moſt amiable Modeſty.

This ſame Spirit ran thro' the whole Exerciſe of Monſieur *Dodart*'s Profeſſion, and was moreover ſtrengthened with an extream Delicacy of Conſcience. A Patient had no occaſion either to fear his Neglect, or even a light and ſuperficial Application, but only (for we muſt tell all the Truth) his too great Care and Application, which render'd him ſometimes Irreſolute in the Choice of his Remedies. The Practice in Phyſick does not always admit of the wiſe Delays of Speculation, and ſometimes even Reaſon it ſelf requires that we ſhould act with Precipitation.

The *Hiſtory* of *France* was the chief Work of Monſ. *Dodart* in the *Academy*, but not the only one; he applied himſelf very diligently to ſtudy the inſenſible Tranſpiration of the humane Body. All the Naturaliſts, and the Phyſicians too, had always a Notion of it, but ſo general and uncertain, that all they knew of it, properly ſpeaking, was only, that there was ſuch a thing as Tranſpiration.

The illuſtrious *Sanctorius*, a Phyſician of *Padua*, was the firſt that knew how to reduce it to Calculation by Experiments, and to compare the Quantity of it with that of the groſſer Evacuations. It far exceeds what one could ever have imagined; there may come out of the Body in one Day, according to the ſaid *Sanctorius*, ſeven or eight Pounds of Matter by Tranſpiration, and as ſuch an abundant Evacuation muſt needs be of great Importance, ſeveral eminent Phyſicians conſider it as one of the principal Foundations both of their Theory and Practice. But ſince *Sanctorius* was the firſt who had conceived theſe fine Notions, he could not be ſuppoſed to have carried them to their utmoſt Perfection. For inſtance, tho' he knew in general that Tranſpiration ought to be different, according to Mens Ages, he does not ſeem to have minded that Difference neither in his Obſervations, nor in the Concluſions he drew from them; but Monſieur *Dodart* ſatisfied himſelf by many Experiments continued for the ſpace of 33 Years, that Tranſpiration is much greateſt in young People: Indeed it is much more natural that the Heat of the Blood becoming more weak in proportion as we grow older, ſhould protrude fewer of the ſubtile Particles, and that at the ſame time the Pores of the Skin ſhould be more cloſed. Monſ. *Dodart* was peculiarly adapted to make theſe kind of Experiments, becauſe they are beſt made upon one's ſelf, and becauſe he that makes them muſt lead an even and uniform Life, and alike not only every Day, but in the different Stages of Life; otherwiſe one could not compare, without great Miſtakes, or at leaſt Uncertainties, the Tranſpirations of different Times. An irregular Alternative of Intemperance and Sobriety would ſpoil all.

He made another Experiment upon the ſame Occaſion, for which the Uniformity of Life would not have ſufficed alone; it may perhaps appear ſurpriſing to affirm, that a great Piety was likewiſe neceſſary thereto. Upon the firſt Day of *Lent*, 1677, he found that he weigh'd one hundred and ſixteen Pounds, one Ounce: He then proceeded to live all the reſt of the *Lent* as was the practice of the Church 'till the 12th Century, that is, he did neither eat nor drink 'till ſix or ſeven a Clock in the

Evening: He lived upon Garden-ſtuff the moſt part of the time, and about the end of it upon Bread and Water. On *Eaſter*-Eve he weigh'd no more than a hundred and ſeven Pounds, twelve Ounces, that is to ſay, he had loſt, by this auſtere way of living, in 46 Days, eight Pounds, five Ounces, which was the fourteenth part of his Subſtance: He then reſumed his ordinary Courſe of Life; and at the end of four Days he had recover'd four Pounds; which ſhews that in eight or nine Days he would have arrived at his firſt Weight, and that one eaſily repairs all that is loſt by Faſting. When he gave an account of this Experiment to the *Academy*, he took all poſſible Precaution to conceal himſelf, but he was diſcover'd. It is extraordinary enough, not that a Philoſopher ſhould be a good Chriſtian, but that the ſame Action ſhould be a curious Obſervation in Philoſophy and a Chriſtian Auſterity, and ſerve at the ſame time both for *Heaven* and the *Academy*.

He made the like Remarks upon Bleeding, that 16 Ounces of Blood, for inſtance, would be recover'd in leſs than five Days in a Perſon that was robuſt and healthy: It remains to know, in how long time a ſick Man might recover his; and it is plain that ſuch Principles would decide the great Queſtion of the Utility or Danger of letting Blood, and would regulate the Proceedings in that matter. But tho' Monſ. *Dodart* himſelf had made many of theſe Experiments in a long Tract of Time, yet he fell far ſhort of perfecting thoſe Enquiries. It appears by what I have been able to collect on the ſame account, that commonly the Strength of Tranſpiration is in the firſt Hours that follow a good

Meal; tho' *Sanctorius* places it about the middle of the Interval between two Meals. This whole Buſineſs does ſtill abound with Uncertainties; and if one did maturely reflect upon the Difficulty of collecting as many Tracts as are wanting with reſpect to different Ages, Temperaments, Climates and Seaſons, it is ſo great, that Naturaliſts muſt almoſt deſpair of reducing it to any certain Rules.

Monſieur *Dodart* had ſome thoughts of compoſing a Hiſtory of Phyſick. Mr. *Le Clerc*, a Phyſician at *Geneva*, and Brother of the famous *Le Clerc* of *Holland*, has worthily perform'd this great Deſign, and in his Preface acknowledges that he had interfered in that Undertaking with the Learned Monſ. *Dodart*, among whoſe Papers were found ſeveral Memoirs relating to that matter; ſuch as about the *Diet* of the *Ancients*, about their *Drink*, *Ptiſan*, &c. The Remarks about Tranſpiration were likewiſe to make part of his intended Hiſtory.

He had alſo projected a *Hiſtory* of *Ancient* and *Modern Muſick*; and that which has been publiſh'd in the *Memoirs* of the *Academy* upon the *Formation* of the *Voice*, was to have been a Preliminary, or Introduction, to it. It is perhaps an Affliction to the Publick, to inform them of theſe different Projects, which have remain'd abortive in ſuch learned Hands; but there is no Great Man who has not given them the ſame Cauſe of Diſſatisfaction: A Genius and Stock of Knowledge ſuggeſts more Deſigns, and inſpires Men with a more enterpriſing Courage, than agrees with the Rigour of humane Condition, and, *perhaps, we ſhould not do all that we are able, if we did not flatter our ſelves with the Hopes of going much farther.* All theſe Projects

jects, begun without encroaching upon the ordinary Duties of his Function, do ſufficiently ſhew how laborious a Man Monſ. *Dodart* was. His Pleaſures and Amuſements were only leſs painful Labours, ſuch as plain Lectures, but which were always Solid and Inſtructive. He read much upon the Matters of Religion, for his Piety was enlighten'd, and to the Light of Reaſon, he always joined the reverend Obſcurity of Faith.

He was Phyſician to a great Number of Poor People, and perhaps to a greater Number than he could well be, according to his Way; for he did not only Cure them, but Feed them too; for which reaſon he was obliged to join in theſe charitable Works with ſeveral People of Figure, and to go about begging Alms himſelf, that he might be the better enabled to beſtow them on the Poor.

At the Age of about 73 Years, after having endured long Torments in the Kidneys without making them known, he was of Opinion that he had the Stone, and reſolved to undergo the Operation of it chearfully. The Princeſs of *Conti* did all that was poſſible towards compoſing a moſt troubled and uneaſie Mind, and did it with ſo much the more Generoſity, as the Diſpoſitions of the Patient obliged her leſs to it. She aſſured him that Monſ. *Dodart* his Son ſhould ſucceed him as her Phyſician, and that ſhe would give his Daughter a Penſion, by way of Suppliment to the ſmall Fortune he was like to leave them.

It was found afterwards that he had not the Stone. He was doomed to loſe his Life in the happieſt manner in the World, by an Action of Charity. One day he over-fatigued himſelf in taking care of ſome poor People, caught a great Cold, and returned to his own Houſe faſting about five a-Clock in the Evening. A Fever, which quickly appeared, and a Defluxion upon the Breaſt, carried him off in ten Days time: He died the fifth of *November*, 1707, a Week before the Anniverſary Meeting of the *Academy* upon St. *Martin's*-day; a Circumſtance very favourable to the Honour of his Memory; for as I was not able to make his Funeral Oration in ſo ſhort a Time, the Abbot *Bignon* did it without any Warning hardly, juſt as his Heart ſuggeſted it to him; and Monſ. *Dodart* is the only Man hitherto that has had that Happineſs.

Whilſt his Diſtemper laſted, the Princeſs of *Conti* ſent every Hour to enquire after his Health, and as ſoon as he was dead ſhe performed all ſhe had promiſed. One might ſuppoſe that all this did only proceed from the general Beneficence of that Princeſs, or from an indifferent Generoſity; but Tears can only come from the bottom of the Heart, when Decency don't require them; and when, on the contrary, the extream Inequality of the Perſons rather ſeems to oppoſe them; to the natural Eloquence which they have in making an Elogium may be joyned the Value and Price that is ſet upon them by the Eyes that ſhed them.

Monſieur *Dodart* was always of a ſerious Temper, and that Chriſtian Attention with which he perpetually watched over himſelf, was not like to diminiſh it; but that Seriouſneſs, far from carrying with it any thing of Sourneſs or Melancholy, diſcover'd at the bottom a wiſe and laſting Joy, which is the Fruit of a refined Reaſon, and of a peaceful Conſcienee. This Diſpoſition does not produce extravagant Mirth, but an even Sweetneſs, which however may become Gaiety for a few Moments, and as it were, by way of ſurprize; and from all that together there reſults an air of Dignity which belongs to Virtue only, and which even Greatneſs it ſelf cannot beſtow. One thing more, which tho' infinitely leſs conſiderable, is very becoming, and Monſ. *Dodart* had it in Perfection, it is a Nobleneſs of Expreſſion; for beſides that it is I know not what part of our Manners, it proves that we have lived in choice and ſelect Company, for in ſuch only it is acquired, and in ſuch only it is brought to Maturity. He had moreover a great natural facility in Speaking, to which he joined that uncommon Merit of never abuſing it; and he had formed to himſelf a Stile, which, without being affected, did only belong to him. He was poſſeſs'd in a high degree of the peculiar Qualities of an Academiſt, that is to ſay, of a Man of Senſe, who knows how to live with his Equals, benefit himſelf by their Lights, and communicate his own to them. In this kind, People had much rather *Give* than *Receive*; tho' giving as one ought, is much more difficult than receiving. *If it be hard to act the Perſon of an Inferiour when one Receives, it is much more hard not to aſſume an Air of Superiority when one Gives:* Monſ. *Dodart* underſtood perfectly both the one and the other; he propoſed his Thoughts with ſuch a Modeſty, as made them become almoſt a new Proof; and he enter'd ſo readily into the Sentiments of others, as if he had not known 'till that Moment what he was informed of by them. He loved to borrow, and to put a Value upon their Notions, and he would much rather have ſucceeded than failed in taking an Opportunity of rendering a kind of Homage for them. It would not be neceſſary to give you a larger Deſcription of his Manners, all of them proceeding from one ſole Principle, a Heart naturally Sincere and Noble, and continually cultivated by Religion.

His Place of *Penſioner Botaniſt* was preſently filled by Monſ. *Burlet*, who had been his *Pupil*; but becauſe Monſ. *Burlet* was firſt Phyſician to the King of *Spain*, he was declared *Veteran*, and the Place of *Penſioner* given to Monſ. *Morin*, Phyſician to the *Hôtel-Dieu*, who was *Aſſociate Botaniſt*.

The LIFE *of Monſieur* TOURNEFORT.

J*Oſeph Pitton de Tournefort* was born at *Aix* in *Provence* the 5th of *June*, 1656, of *Peter Pitton*, Eſq; Lord of *Tournefort*, and his Mother was *Aimare de Fagone*, a Noble Family in *Paris*: He was ſent to the Jeſuits College in *Aix*; but tho' he was only put to the Study of Latin, like all the reſt of the Scholars, as ſoon as ever he ſaw the Plants in their Garden, he found himſelf growing into a *Botaniſt*; he earneſtly enquired after their Names, carefully obſerved their Differences, and ſometimes played Truant to go a Simpling in the Fields, and ſtudied Nature inſtead of the Language of the Ancient *Romans*. The greateſt part of thoſe who have excelled in any kind of Knowledge never had any Maſter: In a little time he learnt of himſelf to underſtand all the Plants round about the City.

When he was come to his Philoſophy, he had very little reliſh for that which they taught him; he did not find in it that Nature which he ſo much delighted to obſerve, but only indefinite and abſtract Idea's, which, as one may ſay, go beſides the things, without touching upon them. He met with the Philoſophy of *Deſcartes*, little known then in his Country, in his Father's Cloſet; and preſently found it to be what he had been looking for. He could not enjoy the reading of it but privately, and by Snatches, but that made him the more eager after it, ſo that his Father, who oppoſed ſo profitable a Study, gave him, without deſigning it, an excellent Education.

As he had devoted him to the Church, he obliged him to ſtudy Divinity, and put him into a Seminary; but Nature prevailed, and he was reſolved to ſee Plants, and ſo made his moſt favourite Studies either in a curious Garden belonging to an Apothecary of *Aix*, or in the neighbouring Fields, or upon the Precipices of Rocks and Mountains: He made his way, either by Art or Preſents, into the moſt private Places, where he gueſſed there were Plants that he could meet with no where elſe; and rather than fail, he would climb over the Walls, inſomuch that he had like to be knock'd in the Head one time by ſome Country Fellows that miſtook him for a Thief.

He had not a leſs violent Paſſion for Anatomy and Chymiſtry, than for Botany. In fine, Natural Philoſophy and Phyſicks challenged him with ſuch Warmth from Divinity, which had unjuſtly taken Poſſeſſion of him, that this latter Science was forced to give him up; he was encouraged by the Example of his Unkle by the Fathers ſide, an able eſteemed Phyſician, and the Death of his Father, which happened in 1677, left him entirely Maſter of his own Inclinations.

He preſently made uſe of his Liberty, and in 1678, viſited all the Mountains of *Dauphiny* and *Savoy*, from whence he brought a great many Plants dried, which were the beginning of his Herbal. Botany is not ſuch a ſedentary and lazy Science, as can be acquired in the Eaſe and Shade of a Cloſet, like Geometry and Hiſtory, or, at moſt, like Chymiſtry, Anatomy and Aſtronomy, which do not require any Operations that are attended with much Buſtling. But this, on the contrary, obliges you to run about Mountains and Foreſts, and to grapple with craggy Rocks, and to expoſe your ſelf on the brinks of Precipices: The only Books that can fully inſtruct us in this Matter, are ſpread by chance over the Surface of the Earth, and you muſt reſolve to undergo the Fatigue and Danger of ſeeking and gathering them up. From hence it comes to paſs, that it is ſo uncommon a thing to excel in this Science, and that degree of Zeal, which is neceſſary to make a learned Man of another kind, is not ſufficient to make a great Botaniſt; and that Zeal likewiſe ought to be accompanied with ſuch a degree of Health, and ſuch a ſtrength of Body, as are equal to it. Monſ. *de Tournefort*

nefort was of a briſk, laborious and robuſt Conſtitution; the great Stock of natural Livelineſs ſupported him in his Buſineſs, and his Body as well as Mind were both made for Botany.

In 1679, he ſet out from *Aix* to *Montpellier*, where he improved himſelf very much in Anatomy and Phyſick. A Garden of Plants, which was the Gift of King *Hen.* IV. to this City, as rich as it was, could not ſatisfie his Curioſity. He made hisExcurſions above ten Leagues round *Montpellier*, and brought back Plants unknown even to the People of the ſame Country; notwithſtanding which, he was reſolved to extend his Enquiries much farther, and ſo in the Month of *April*, 1681, left *Montpellier* for *Barcelona*, and went even as far as *St. John's* in the Mountains of *Catalonia*; whither he whs followed by the Phyſicians of the Country, and the young Students, to whom he deſcribed the Plants. One might have compared him upon this Occaſion to the old *Gymnoſophiſts*, that uſed to carry their Diſciples into the Deſerts where they kept their School.

The lofty *Pyrenëan* Mountains were too near not to tempt him, tho' he knew that he ſhould meet with no other Subſiſtance in thoſe vaſt Solitudes, but ſuch as ſerved the moſt rigid Hermits; and that the miſerable Inhabitants that were to provide it for him, did ſcarce exceed in Number the Robbers whom he had to fear; and indeed he was ſeveral times actually plunder'd by the *Spaniſh Miquelets*.

This made him find out a Stratagem by which he cheated thoſe Thieves, and ſaved a little of his Money; he put it into ſome Loaves of Bread, which he carried with him, and which were ſo black and ſo hard, that tho' they ſearched him very carefully, and were not ſo nice as to deſpiſe any thing, yet they ſcorned to touch his Bread.

His predominant Inclination made him ſurmount all Difficulties; thoſe dreadful, and almoſt unaceſſable Rocks that encompaſſed him on all ſides, appeared to him no other than a ſtately Library, in which he had the Pleaſure of finding all that his Curioſity required, and in which he ſpent his Time moſt luxuriouſly. One day a miſerable Cottage in which he lay fell down all at once, and he was two Hours buried under the Ruins of it, and had infalliably periſhed, if People had not come in the mean time to his Relief.

He returned to *Montpellier* at the end of the ſame Year 1681, and from thence to his own Country of *Aix*, where he rank'd in his Herbal under their proper Claſſes, all the Plants he had collected in *Provence*, *Languedoc*, *Dauphiny*, *Catalonia*, the *Alps* and the *Pyrenëan Mountains*. It is not for all the World to underſtand that the Pleaſure of ſeeing a vaſt number of ſuch Plants very compleat, well preſerved, diſpoſed in good Order, in great Books of white Paper, could ſufficiently recompence all the Pains he had taken, and Charges he had been at, in bringing them together.

'Twas the good Fortune of Plants, that Monſ. *Fagon*, at that time firſt Phyſician of the late Queen, had applied himſelf very much to the Knowledge of them, as one of the moſt curious Parts of Natural Philoſophy, and one of the moſt Eſſentials to Phyſick, which made him favour the Science of Botany, with all the Power that that his Place and

Merit gave him. The Name of Monſieur *Tournefort* came to him from ſo many places, and always with ſo much Uniformity, that he had a great mind to draw him to *Paris*, the general Rendezvous of almoſt all the great Talents diſperſed in the ſeveral Provinces: He applied himſelf for that purpoſe to Madam *de Venelle*, Sub-Governeſs of the Children of *France*, who was well acquainted with all the Family of the *Tourneforts*. She prevailed upon him to come to *Paris*, and in 1683, brought him to Monſ. *Fagon*, who at the ſame time procured him the Employment of Botanick Profeſſor to the Royal Garden of Plants, founded at *Paris* by *Lewis* XIII. for the Inſtruction of Young Students in Phyſick.

This Office did not hinder him from making ſeveral Voyages.

He returned into *Spain*, and from thence to *Portugal*, where he ſaw Plants that were ſcarce known to any Botaniſt.

In *Andaluſia*, which is a Country abounding in *Palm-Trees*, he had a mind to learn the Truth of what has been ſo long related concerning the Loves of the *Male* and *Female* of that Kind, but he could diſcover nothing certain; and thoſe ancient Amours, in caſe there be any ſuch, do ſtill remain a Myſtery. He went likewiſe into *Holland* and *England*, where he found both Plants and ſeveral great Botaniſts, whoſe Eſteem and Friendſhip he quickly gained, of which there can be no greater Proof given than the Deſire that Monſ. *Herman*, a famous Profeſſor in Botany at *Leyden*, had of reſigning his Place to him, being very old himſelf. He writ to him about it at the beginning of the laſt War very earneſtly, and the Zeal he had for the Science he profeſſed, made him chuſe a Succeſſor, who was not only a Foreigner, but of a Nation that was at that Time an Enemy to his. He offer'd Monſieur *Tournefort*, in the Name of the States-General, a Penſion of 4000 Livres a Year, and gave him hopes of an Augmentation when he ſhould be better known. The Salary belonging to his Office in the Royal-Garden was very moderate; however the Love of his Country made him reject thoſe agreeable and advantageous Encouragements. He had likewiſe another Reaſon which he communicated to his Friends, *viz.* That he found the Sciences were at leaſt arrived at as high a pitch of Perfection in *France*, as in any other Country. And a learned Man looks upon none to be his true Country, but where the Sciences are in a flouriſhing Condition. *France* was not ungrateful to him for that Preference. The *Academy* of *Sciences* having been put under the Direction of the Abbot *Bignon*, in the Year 1691, one of the firſt Uſes that Gentleman made of his Authority two Months after he had been inveſted with it, was to chuſe into the Body Monſ. *Tournefort* and *Homberg*; neither of whom were otherwiſe known to him, than by the Reputation they had acquired. After they had been approved by the King upon his Recommendation, he preſented them both at once to the *Academy*, two firſt Born, as one may ſay, and both worthy to be ſo of ſuch a Father, and an Earneſt of the whole ingenious Family that has followed them.

In 1694, appeared the firſt Work of Monſieur *Tournefort*, entitled, *The Elements of Botany*, or, *The Method of knowing Plants*; Printed at the *Louvre*, in 3 Vols. *Octavo.* It brings into Order that prodigious number of Plants ſo confuſedly diſperſed upon the Earth, and even under the Waters of the Sea, diſtributes them into their Kinds and Species, facilitates the Knowledge of them, and hinders the Memory of a Botaniſt from being over-loaded with an Infinity of different Names.

This Order, tho' ſo very neceſſary, is not contrived by Nature, which prefers a magnificent Confuſion before the Eaſe and Convenience of the Naturaliſts, and it is their Buſineſs to range them, and bring them under a Syſtem, almoſt in ſpight of Nature. Since therefore it can only be a Work of their Genius, it is eaſie to foreſee that they will be divided upon it, and even that ſome of 'em will be for no Syſtem at all: That which Monſ. *Tournefort* thinks the beſt, after a long and learned Diſcuſſion, conſiſts in regulating the Kinds of Plants by the *Flowers* and *Fruits* taken together; that is to ſay, that all the Plants that agree in thoſe two Parts, ſhall be accounted of the ſame Kind, after which the Differences either of the *Root*, of the *Body*, or *Leaves*, ſhall conſtitute their different Species. Monſieur *Tournefort* has even gone farther: Above the *Kinds* he has placed *Claſſes*, which are only regulated by the *Flowers*, and he is the firſt that had this Thought, which is much more uſeful in Botany than one would be apt to think at firſt. For 'till now there does not appear above 14 different *Figures* of *Flowers* neceſſary to be impreſt upon the Memory; ſo that if you take into your hands a Plant in Flower, of which you know not the Name, you preſently find in his *Elements of*

Botany, to what Claſs it belongs; ſome Days after the Flower appears the Fruit, which determines the *Genius* in the ſame Book, and the other Parts ſhew the *Species*, ſo that you find in a Moment both the Name given by Monſ. *Tournefort* with reſpect to his Syſtem, and the Names given by the reſt of the moſt famous Botaniſts, either out of their own particular Syſtems, or without any Syſtem at all: By this means one is able to ſtudy a Plant in the Authors that make mention of it, without danger of applying to it what they have ſaid of another, or of attributing to another what they may have writ concerning this. 'Tis a wonderful Eaſe to the Memory that all is reduced to the retaining 14 Figures of Flowers, by the means whereof one deſcends to 673 *Kinds*, under which are comprehended 8846 *Species* of Plants, whether belonging to the Earth or the Sea, all known at the Time of publiſhing this Book. What would it be, if one were obliged to learn immediately theſe 8846 *Species*, and that under all the different Names that Botaniſts have been pleaſed to beſtow upon them? What we now ſay might perhaps require ſome Reſtrictions or Explanations: But they have been already given in the Hiſtory of the Year 1700, where the Syſtem of Monſieur *Tournefort* has been more fully treated of.

This Book appeared to be very well approved by the Naturaliſts, and that ought never to be underſtood otherwiſe than of the greateſt number of Naturaliſts. It was attacked upon ſeveral Heads by Mr. *Ray*, a famous *Engliſh* Botaniſt, and Natural Philoſopher, whom Monſieur *Tournefort* anſwered in 1697, by a Latin Diſſertation, inſcribed to Dr. *Sherrard* another Engliſhman, and Learned in the ſame Science. The Diſpute was without Bitterneſs, and even handled civilly enough on both Sides, which is remarkable. It may be ſaid perhaps that the Subject was not worth the while, for what was it about? To know whether the Flowers and the Fruits ſuffice to eſtabliſh the Genus? and whether one particular Plant was of this or that Kind? But it is a Favour if Men, and particularly the Learned, don't fall into a Paſſion while they are diſputing upon the ſmalleſt Matters. Monſieur *Tournefort*, in a Work ſubſequent to theſe Debates, has beſtowed great Encomiums upon Mr. *Ray*, and even upon his Syſtem of Plants too.

He was admitted to his Doctor's Degree by the Faculty of the Phyſicians at *Paris*, and in 1698, publiſhed a Book entitled, *A Hiſtory of the Plants that grow about* Paris, *together with their Uſe in Phyſick.* It may eaſily be imagined that he who had been looking for Plants upon the Tops of the *Alps* and the *Pyrenëes*, would not ſuffer the Country about *Paris* to eſcape his niceſt Enquiries, ſince it was the Place of his Reſidence. Botany would be but a ſimple Curioſity if it were not for its Relation to Phyſick, and one makes the beſt uſe of it when one applies ones ſelf chiefly to ſtudy the Botany of ones own Country; not but that Nature may have been likewiſe as careful, as ſhe is ſometimes ſaid to be, in beſtowing upon every Country the Simples that are beſt adapted to the Diſtempers of the reſpective Inhabitants; but however it is moſt convenient to make uſe of thoſe that are at hand, and very often ſuch as are fetch'd from far, are not the better for that. In this Hiſtory of the *Pariſian Plants* Monſ. *Tournefort* gives an account, beſides their different Names and Deſcriptions, of the Chymical Analyſis made of them by the Academy, and of their moſt aſcertained Qualities. This Book alone might ſufficiently obviate the Reproach that is ſometimes made by Phyſicians of undervaluing the Remedies drawn from Simples, becauſe they are too eaſie and of too quick an Effect. Certainly Monſ. *Tournefort* produces a great Number of them, and yet they are for the moſt part but too much neglected, and we ſeem to be under a kind of a Fatality in deſiring them much, and uſing them but little.

One may count among the Works of Monſieur *Tournefort*, a Book, or at leaſt a part of a Book, which however he did not publiſh: the Title of it is, *Schola Botanica, ſive Catalogus Plantarum, quas ab aliquot annis in Horto Regio Pariſienſi ſtudioſis indigitavit Vir Clariſſimus J. P. de Tournefort, D. M. ut & P. Hermani Paradaſi Batavi Prodromus, &c. Amſtel.* 1699. An *Engliſhman*, named Mr. *Simon Wharton*, who had ſtudied Botany three Years at the King's Garden under Monſ. *Tournefort*, compoſed this Catalogue of the Plants which he had ſeen there.

As the *Elements of Botany* met with all the Succeſs the Author himſelf could wiſh for, he Tranſlated it into *Latin*, and publiſhed it in 1700, for the Benefit of Foreigners, with Additions, under the Title of *Inſtitutiones Rei Herbariæ*, in three Volumes in *Quarto*; the Firſt of which contains the Names of the Plants diſtributed according to the Author's Syſtem; and the other two, their Figures very well engraven. At the Head of the Tranſlation there is a large Preface or Introduction to Botany, which contains, beſides the Principles of Monſ. *Tournefort*'s Syſtem ingeniouſly and ſolidly laid down, *a Hiſtory of Botany and of Botaniſts*, collected with great Care, and writ in a very agreeable Stile. One may eaſily believe, that he employed himſelf with Pleaſure in every thing that had a relation to the Object of his Love.

This Love however was not ſo faithful and conſtant to Plants, but that it extended it ſelf with the ſame Zeal almoſt to all the other Curioſities of Nature; ſuch as figured Stones, uncommon *Marcaſſites*, extraordinary *Petrifications* and *Chryſtallizations*, and *Shells* of all Kinds. It is true, that out of the Number of theſe ſorts of Inconſtancies, his Love for Stones may be excepted, becauſe he ranked them among the Number of Vegetables, and ſuppoſed them to come from Seeds; nay, he was ſufficiently inclined to extend this Syſtem even as far as Metals, and it ſeems, if it were poſſible, that he transformed himſelf into that which he moſt loved.

He made a Collection likewiſe of the *Dreſſes*, *Arms* and *Inſtruments* of remote Nations, other kinds of Curioſites, which tho' they do not immediately come out of the hands of Nature, are not the leſs Philoſophical, eſpecially when they fall into thoſe of a Philoſopher; of all theſe things together, he had formed a ſplendid Cabinet for a private Perſon, and famous in *Paris*. It was eſteemed by the Curious to be worth near 50000 Livres. Such a great Expence would have been a

Blot in the Life of a Philoſopher, if it had been made upon any other occaſion; it proves that Monſ. *Tournefort* with ſo narrow a Fortune as his was, could allow little or nothing to more trivial, and yet more practiſed Pleaſures.

With all theſe good Qualities, it is eaſie to judge how fit he was for a Traveller; by which Term I don't mean the Common Travellers, but only ſuch in whom is found both a very enlarged Curioſity, which is rare enough, and a certain Gift of Seeing with Diſcretion, which is yet more rare. The Philoſophers ſeldom run about the World, and thoſe that ſee moſt of it, are uſually the leaſt of Philoſophers; ſo that the Travels of a Philoſopher are extreamly valuable.

We reckon it alſo a great Advantage to Learning, that Monſieur *Tournefort*, in the Year 1700, received the King's Orders to go into *Greece*, *Aſia*, and *Africa*, not only to learn the Plants of the Ancients, and perhaps too thoſe that might have eſcaped them, but moreover to make his Obſervations upon all the whole *Natural Hiſtory*, *upon the Ancient and Modern Geography*, *and even upon the Manners*, *Religion*, *and Commerce of thoſe People*. He was ordered to write as often as he could to the Count *de Pontchartrain*, who procured him all the Conveniences imaginable in his Voyages, and to inform him in particular of his Diſcoveries and Adventures.

Monſieur *Tournefort*, accompanied with Monſ. *Gundelſheimer* a *German*, and an excellent Phyſician, and Monſ. *Aubriet*, a skilful Painter, went as far as the Borders of *Perſia*, always ſimpling and obſerving. Other Travellers into theſe Parts go by Sea as much as they can, becauſe it is moſt convenient for them; and when they travel by Land, they chuſe the moſt frequented Ways; but theſe Gentlemen made as few Sea Voyages as they could, and wander'd always out of the Common Roads, finding out new ones in the moſt unacceſſible Places. We ſhall ſhortly read, with Pleaſure and Horror intermixed, the relation of their Deſcent into the *Grotto* of *Antiparos*; that is to ſay, into three or four moſt dreadful Caverns ſucceeding one another. Monſieur *Tournefort* had the ſenſible Satisfaction to diſcover there a new kind of Garden, all the Plants of which were different pieces of Marble, either juſt produced, or very young; and which according to all the Circumſtances that attended their Formation, could not but have vegetated. In vain did Nature hide her ſelf in ſuch Abyſſes and inacceſſible Depths, to work more ſecretly upon the Vegetation of Stones, ſince ſhe was, as one may ſay, taken in the very Fact by theſe curious and intrepid Virtuoſo's.

Africa was included in the Scheme of Monſieur *Tournefort*'s Voyage; but the Plague which reign'd in *Egypt*, made him return from *Smirna* to *France* in 1702. this was the firſt ſtop he met with.

He returned, as a great Poet ſays upon a leſs noble and uſeful Occaſion, *loaden with the Spoils of the Eaſt*. He brought back with him, beſides an Infinity of different Obſervations, 1356 new Species of Plants; a great part of which ranged themſelves under ſome of the 673 Genus's that he had eſtabliſhed, ſo that he was only obliged to create for all the reſt, but 25 new Genus's, without any augmentation of the Claſſes, which proves the Convenience of a Syſtem, under which ſo many exotick Plants, and that were not expected, were ſo eaſily reduced. He compoſed from thence his *Corollarium Inſtitutionum Rei Herbariæ*, *Printed in* 1703.

When he was returned to *Paris*, he thought of reſuming the Practice of Phyſick, which he had ſacrificed to his Travels in the *Levant*, at a time when it had begun to be very good: Experience ſhews that in all things depending upon the Taſt of the Publick, and eſpecially things of this nature, Interpoſitions are dangerous; the Approbation of Mankind is, as it were, raviſh'd from them, and therefore always haſtens to an End. Monſieur *Tournefort* therefore found ſome Difficulty in reviving his Buſineſs he had left off; beſides, he was obliged to perform his ancient Exerciſes in the Royal Garden, to which he joyned thoſe of the Royal College, where he had a Place of Profeſſor in Phyſick; the Functions of the Academy did likewiſe require ſome part of his Time, over and above all which, he ſet himſelf about a Relation of his great Voyage, of which he had only brought back a few ſhort Memoirs and Hints, that no body but himſelf underſtood. The Buſineſs and Labours of the Day, which made the Nights Reſt more neceſſary to him, obliged him on the contrary, to ſpend his Nights in new Labours; and it was his Misfortune to be of a ſtrong Conſtitution, becauſe he was thereby encouraged to make more bold with himſelf for a long while, without perceiving any ſenſible Inconvenience. But at laſt his Health began to give way, and yet he would not ſpare it. When he was in this bad Diſpoſition, he received by Accident a violent Blow upon the Breaſt, of which he himſelf believed he ſhould quickly die. After that he did nothing but languiſh, during ſome Months, and then died on the 28th of *December*, 1708.

By his Will he left his Cabinet of Curioſities to the King for the uſe of the Learned; and his Books of Botany to the Abbot *Bignon*. This ſecond Item ſhews no leſs than the firſt, his Love for the Sciences, ſince the giving them to him who watches for Learning, and encourages it with ſo much Zeal in this Kingdom, is really making a Preſent of them to Learning it ſelf.

Of the two Volumes in Quarto, which were to have contained the Travels of Monſieur *Tournefort*, the firſt was printed at the *Louvre* before he died; and they are finiſhing the Second from the Manuſcript of the Author, which was left ſo compleat, that nothing could be added to it. This Work, which keeps its firſt Form of Letters written to Monſieur *de Pontchartrain*, will have 200 Copper-plates very well graven, of Plants, Antiquities, *&c.* and there will appear in it, beſides all the Learning that we have hitherto repreſented, his great Knowledge of Ancient and Modern Hiſtory, and a vaſt Erudition, of which we have made no mention, for fear of its looking like Flattery. Oftentimes one predominant Quality makes us neglect others, which however do well deſerve to be taken notice of.

His place of *Penſionary Botaniſt* was filled by Monſieur *Magnol* of *Montpellier*.

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The LIFE of *Monſieur* TSCHIRNHAUS.

ERnfroy Walter de Tſchirnhaus, Lord of *Kiſlingſwald* and *Stoltſenberg*, was born the 10*th* of *April*, 1651, at *Kiſlingſwald* in the upper *Luſatia*, of *Chriſtopher Tſchirnhaus* and *N—— de Sterling*, both of them of an ancient Family. It was about 400 Years ſince the Houſe of *Tſchirnhaus*, which came out of *Moravia* and *Bohemia*, had been poſſeſſed of this Lordſhip of *Kiſlingſwald* near the City of *Gorlits*.

Monſieur *Tſchirnhaus* was put under the Care of all thoſe Tutors for the Sciences that are uſually allowed to Perſons of his Condition, but he anſwered their Cares quite otherwiſe than Perſons of his Rank were uſed to do. As ſoon as ever he had heard that there was ſuch a thing in the World as *Geometry*, he greedily laid hold of it, and from thence he paſſed with Rapidity to the other Branches of the Mathematicks, which, by offering him a thouſand agreeable Novelties, rival'd each other in his Curioſity.

At the Age of 17 Years his Father ſent him to finiſh his Studies at *Leyden*, where he arrived at the time of an Epidemical Diſtemper, which had like to have coſt him his Life. Tho' he was ſo Young he ſoon attained to a great Reputation among the Learned Men of *Holland*; but the War breaking out in 1672, he turned Soldier, and ſhewed that he knew as well how to perform his Duty, as to follow his Inclination. This prevailing Inclination for Learning, did even contribute towards making him take to Arms; for it was the occaſion of uniting him in a ſtrict Friendſhip with the Baron *de Newland*, who had the ſame Taſt for Letters as he had; and as this Baron was in the Service of the States, he prevailed with Monſieur *Tſchirnhaus* to engage himſelf likewiſe in the ſame as a Volunteer, to the end that they might keep together. Monſieur *Tſchirnhaus* ſerved eighteen Months, after which he was obliged to return into his own Country, from whence he ſet out ſome time after to Travel, according to the Cuſtom of the Gentlemen of his Nation, who are of opinion, that the Knowledge and Correſpondence with others is neceſſary to poliſh and improve themſelves. He travelled through *England*, *France*, *Italy*, *Sicily* and *Malta*; in all the Countries through which he went, he viſited the Learned Men, and every thing that is proper to be ſeen by the Learned, as the Curioſities of Natural Hiſtory, extraordinary Works of Art, and particular Manufactures.

This great number of different Things, well obſerved, are not ſimple Facts, and uſeleſs Ornaments of Memory in an Ingenious Man; they become the Principles of an Infinity of Views, to which the fineſt Theory, void of Experience, could never attain. The more ſuch Eyes ſee, the more Reaſon it ſelf ſees.

Monſieur *Tſchirnhaus* returned to *Germany*, and ſpent ſome time at the Court of the Emperor *Leopold*; for a Philoſopher may viſit even Courts, were it only to obſerve the Manner and Faſhion of thinking there, which he could not ſo eaſily diſcover otherwiſe.

In the midſt of this agitated way of Living, or at leaſt in a Life ſufficiently mingled with Motion, Learning, and eſpecially Mathematicks, always employed our Accademiſt. He had acquired by Art a Habitude of not being eaſily diſturbed, and had innured himſelf to Diſtractions. In the Year 1682, he came to *Paris* for the third time, and brought with him Diſcoveries, which he was deſirous to propoſe to the *Academy of Sciences*; it was the famous *Cauſticks* that go by his Name, for we commonly ſay the Cauſticks of Monſieur *Tſchirnhaus*, as we do the *Spiral* of *Archimedes*, the *Conchoid* of *Nicodemus*, the *Ciſſoid* of *Diocles*, and the *Cycloid* of Monſieur *Huygens*; and a Geometrician ought to be no leſs proud of having given his Name to a *Curve*, or to an entire Species of *Curves*, than a Prince of having given his to a City. Monſieur *Tſchirnhaus*, tho' he was yet but 31 Years old, was by the King placed among the number of thoſe very Academiſts whom he came to conſult, and in ſome manner to take for his Judges.

Every Body knows that *Cauſticks* are Curves, formed by the Concourſe of the Rays of Light, which any other Curve whatever has either reflected or refracted; they have one remarkable Property, *viz.* that they are equal to known Right Lines, when the Curves that produce them are Geometrical; ſo Monſieur *Tſchirnhaus* diſcover'd that the *Cauſtick* formed in the fourth part of a Circle, by Rays reflected, which became preſently parallel to a Diameter, was equal to the ¾ of the Diameter. The Rectifications of the Curves, which at this very time are not common, were much leſs ſo then;

and beſides, it is a great Merit in this Diſcovery, to have preceded the Invention of the *Calculation* of the *Infinites*, which would have render'd it much more eaſie; the Academy judged it worthy to be particularly examined by a Committee, who were Meſſieurs *Caſſini*, *Mariotte* and *de la Hire*; this laſt conteſted with Monſieur *Tſchirnhaus* a Generation or Deſcription which he gave the *Cauſtick* by *Reflexion*, of the Quarter of the Circle. Monſieur *Tſchirnhaus*, who would not ſhew the Ground of his Method, did not yield to Monſieur *de la Hire*, and this latter perſiſted in looking upon the Generation aforeſaid as very ſuſpicious; however, the Author of it thought himſelf ſo ſure, that he ſent it to the Journal of *Leipſic*, but without any Demonſtration.

He return'd to *Holland*, where he furniſhed and left in the Hands of his Friends a Treatiſe, entitled, *De Medicinâ Mentis & Corporis.* He had begun to write at the Age of Eighteen Years, and even with the deſign of Printing, inſeparable almoſt from that of Compoſing, of which it is the firſt Reward. He had made, at ſeveral times, ſome Treatiſes, with which both his Friends and himſelf were very well pleaſed; but by good luck, he had not been able to Print them ſo ſoon, ſo that when he came to Reviſe them, he was ſo diſatisfied with his own Performances, that he took a firm Reſolution to Print nothing 'till he was 30 Years old, and to ſacrifice all the Children of his Youth: *A Sacrifice ſo much the more hard and uncommon, as thoſe Children are born at a Time when one loves with moſt Zeal, and leaſt Knowledge.* The Period which he had preſcribed to himſelf was paſt, when his firſt Work, which indeed was the only one Publiſhed, appeared at *Amſterdam* in 1687. He Dedicated it to the King, as a Proof of his Gratitude for his Majeſty's Favour in making him an Academiſt. The Title of the Book is, as I may ſay, double to that of *the Search after Truth*, for the Aim of this latter is only to rectifie or heal the Mind, but the other takes in the Body alſo. *With good Logick, and good Phyſick, Men would ſtand in need of nothing.*

To give an Inſtance of the Method of leading the Mind thro' the Sciences, by riſing always from the more Simple to the more Compound, and by combining together Truths, in proportion to their Birth or Production, Monſieur *Tſchirnhaus* propoſes an univerſal Generation of Curves by Centres or Focus's, whereof the number increaſes always, and at the ſame time increaſes the Degree of which the Curve is. He pretends to draw from thence a general Method for the Tangents, in which he mightily glories, and a great many other Theorems and importent Problems; and upon this occaſion inſinuates, that he does not believe himſelf miſtaken upon the *Cauſtick* of the quarter of a Circle. Monſieur *de la Hire* has ſince demonſtrated in his *Treatiſe of the Epicycloids*, publiſhed in 1694, that this *Cauſtick* was one of 'em, that indeed it was of the Length determined by Monſieur *Tſchirnhaus*, but could not be deſcribed in the manner he had propoſed: It is no ſtrange thing to make a wrong Step in new Roads, and ſuch as we are forced to open for our ſelves; an Original Genius, which is warm, bold and lively, may perhaps be not always as wary and circumſpect as it ought to be; in the Book of Monſieur *Tſchirnhaus* one perceives that Fire and Boldneſs which is peculiar to the Spirit of Invention. If the Author had not done a great deal, one might readily believe that he promiſes too much, and raiſes our Hopes too high.

The Precepts of Theory which he lays down are not ſo ſingular as certain Practical Inſtructions that he adds, or rather certain Cuſtoms, which he found very uſeful to him; we will repeat them here, becauſe nothing can better repreſent the Detail of his private Life, with reſpect to his Studies. He made his Experiments in Summer, and in Winter put them in Order, or drew his Conſequences from them, or laſtly, made great Enquiries in Theory, finding that Seaſon the moſt proper for Meditation. About the End of Autumn he applied himſelf to the Care of his Health, and made a kind of a Review of his Bodily Strength, againſt that Seaſon which he had devoted to the greateſt Labours of the Mind. He read over the Compoſitions of the foregoing Winter, recalling the Idea's thereof, and exciting in himſelf a deſire of continuing them; and then he began to retrench his Supper Meals, and even to diminiſh by little and little thoſe of Dinner; inſtead of Supper he either read concerning the Matters upon which he had a deſign to treat, or elſe diſcourſed about 'em with ſome learned Friend. He went to Bed at Nine of the Clock, and was called up again at Two. He kept himſelf for a while exactly in the ſame Situation in which the Wakening found him; this hinder'd him from forgetting what he dream'd of at that inſtant; and if, as it might happen naturally enough, his Dream turned upon the Matter wherewith his Mind was full, he could more eaſily proceed upon it. He worked in the Silence and dead of the Night, went to ſleep again at Six a Clock, but only till Seven, and then reſum'd his Labours. He ſays, that he never made greater Progreſs in the Sciences, nor never found himſelf more Vigorous or nimble, than when he obſerved all theſe Methods with the greateſt Regularity. One may find in it an exceſſive Care of managing and improving all poſſible Advantages; but all great Paſſions move with a kind of Superſtition in relation to their Object.

During the Night, he uſed to ſee a great number of very active Sparks, that danced and played about in the Air; when he look'd at them ſteadily they diſappeared, but when he did not mind them, they did not only continue as long as his Application to Buſineſs, but their Brightneſs and Vivacity ſeem'd to redouble. At laſt he came to ſee them in broad Day, after having acquired a certain Degree of Facility in Meditating. He ſaw them upon a white Wall, or upon a piece of Paper that he placed near him. Theſe Sparks, only viſible to him, were at the ſame time both an Effect and a Repreſentation of the Spirits in his Brain under a violent Agitation.

This Ardent Paſſion for Learning, gives us naturally enough the Idea of a Man extreamly Covetous of Glory; for in ſhort, there are no great Works without great Motives, and the Men of Learning are the Ambitious Men of the Cabinet. However, Monſ. *Tſchirnhaus* was not ſo, he did not aſpire by all his Vigils to *that Immortality which affects us ſo much, and belongs ſo little to us*; and he told ſome of his Friends, that even from the Age of 24 Years, he believed he had freed himſelf from the Love of Pleaſures, Riches, and even of Glory too. Some Men have a right to bear Teſtimony of themſelves; but he loved the Sciences with that pure and diſintereſted Love, which does ſo much honour both to the Object that inſpires it, and to the Heart that feels it; the manner wherewith he Expreſſes himſelf in ſome Places, upon the Raptures produced in him by the Enjoyment of Truth, is ſo Lively and ſo Animated, that it would have been unpardonable in him to have expected any other Reward.

The Treatiſe, *De Medicina Mentis & Corporis*, does likewiſe contain his Principles upon Health; his attachment to Learning did not ſo entirely ſequeſter him from the World, but that he found himſelf ſometimes obliged to live with other Men, and after their Manner, and conſequently to Eat and Drink too much. He propoſes rather ſome Precautions to prevent the Evils of this kind of Life, than Medicines to cure it, unleſs you will ſay that *Swetting*, of which he had a great Opinion, and to which he had always recourſe, is at the ſame time both a Prevention and a Remedy. As for the reſt, he looks upon every thing as Poiſon, that is not Food or Nouriſhment. He would have us attend to, and follow that ſimple Taſt free from all Reflection, that carries us to certain kinds of Food, or a like diſguſt which diſwades us from it; theſe things being ſecret Warnings of Nature, if at leaſt you will allow that Nature takes ſo much Care of us, and that we may rely ſo much upon her. He ſays, that being under an Obligation of Eating much, he did eat, at leaſt alternately, things very oppoſite, Hot and Cold, Salt and Sweet, Sharp and Bitter; and that this Mixture, which ſeem'd ſo odd to the reſt of the Company, and which they even looked upon as an Effect of Intemperance, ſerved to correct the Exceſs of the oppoſite Qualities in the things he fed on. One ought to ſay for his Honour, that theſe kinds of Singularities in which the Care of his Health engaged him, were not ſo great as thoſe occaſioned by his Love of Learning.

After the Publication of his Work, being at home in *Saxony*, he began to think upon the Execution of a great Deſign which he had formed a long time. He was of opinion, that unleſs we can render Opticks more perfect, our Progreſs in the Diſcoveries of Nature, would be confined in a manner within the ſame Bounds, in which it now is; and that in order to know more of Nature, we muſt ſee her better. Beſides, he who had been the Inventor of the *Cauſticks*, foreſaw the larger and better Convex Glaſſes expoſed to the Sun, would be a kind of new Furnaces, and conſequently produce a new Chymiſtry. But in all *Saxony* there were no Glaſs-Houſes fit to put in Practice theſe his great Projects. He obtained therefore, of the Elector his Maſter, the Privilege of ſetting up one, as they ſoon perceived how Advantagious it would be to the Country, he eſtabliſhed three of them. From thence proceeded Novelties both in *Dioptricks* and *Phyſicks* almoſt miraculous. We have given an account of them upon the Word of Monſ. *Tſchirnhaus*, in our Hiſtory of the Year 1699 and 1700; ſome of them were of ſuch a nature as hardly to obtain

Belief; for in perfecting the *Dioptricks*, they turned them upſide down: However, the Burning-Glaſs which the Duke of *Orleans* purchaſed of this Gentleman, is at leaſt an irreproachable Evidence of a great part of what he had advanced.

This Burning-Glaſs is convex on both ſides, and is a part of two Spheres, the Radius of each of which is twelve Foot. Its Diameter is of three *Rhine-land* Feet, and it weighs 160 Pounds, which is an enormous ſize, with reſpect to the greateſt Convex-Glaſſes that have ever yet been made. The Sides or Edges of it are as compleatly wrought as the Middle, and that which clearly proves it, is, that its Focus is exactly round. This Glaſs puzzles the moſt skilful People, whether it was wrought in Baſons, like the ordinary Glaſſes of that kind, or whether it was caſt in a Mould? We may eaſily be divided upon the Queſtion, for there are great Difficulties in each manner; and nothing is a more noble Panegyrick upon Monſieur *Tſchirnhaus*'s Skill in the Mechanicks than this. He affirms, but perhaps he had no mind to reveal his Secret, that he had cut it in Baſons, and that the Maſs of that Matter out of which he had taken it weigh'd ſeven hundred Pounds, which would be yet another Miracle in the Glaſs Trade. He had made another that was four Foot in Diameter, but it was ſpoiled by ſome Accident. He preſented a Glaſs of this kind to the Emperor, who to acknowledge his Gift, and yet more his Merit, would have beſtow'd on him the Title and Prerogatives of a Free Baron; but he declined them with all the Reſpect that ought to attend ſuch a Refuſal; and of all the Favours offer'd him, he only accepted

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the Picture of his Imperial Majeſty, with a Chain of Gold. To render this Account the more credible, it may not be amiſs to ſupport it with a parallel Story. The Elector of *Saxony* offer'd to make him a Counſellor of State, but he refuſed that Honour likewiſe. One may ſuſpect that a Man who does not ſeek after Preferments has a mind either to ſpare himſelf a great deal of Pains, or the Shame of not ſucceeding; but the moſt ingenious Malice has nothing to ſay againſt him, who flies from Honours that come and offer themſelves of their own accord to him.

He return'd to *Paris* the fourth time in the Year 1701, and attended the Academy pretty diligently: He there diſcloſed ſeveral Methods, which he had invented for the moſt ſublime Geometry, but he did not demonſtrate them; contenting himſelf to have excited a certain uneaſie Curioſity, and perhaps alſo Doubts, which would have been honourable to his Diſcoveries, in caſe they could have been well made out. In our Hiſtory of 1701, we have given a Liſt of his Proportions. He pretended he could proceed without the Method of the *Infinitely Littles*, and gave the Academy, upon the *Radii of the Cycloids*, a Sketch of what he ſubſtituted to it. Nothing can better prove the great Uſefulneſs of the *Infinitely Littles*, than when People pretend not to ſtand in need of 'em upon certain Occaſions. In general Monſieur *Tſchirnhaus* would render Geometry more eaſie, by perſwading himſelf that the true Methods are eaſie, that the moſt ingenious are not true, as ſoon as they become too complicate; and that Nature does every thing in the moſt ſimple manner: All this is true; but the Queſtion is how to determine the Degree of Simplicity; the Learned think they have now attained to it.

During his ſtay at *Paris* Monſ. *Tſchirnhaus* communicated to Monſ. *Homberg* a Secret of his own Invention, and as ſurpriſing as that of cutting his Great Glaſſes; it was to make Earthen Ware exactly like that of *China*, and which would conſequently ſave a vaſt deal of Money to *Eurcpe*. It has been thought hitherto, that that kind of Earthen Ware was a particular Favour beſtow'd by Nature upon the *Chineſes*; and that the Stuff of which it was compoſed, was only to be found in their own Country. But it is no ſuch thing; for it is a mixture of certain Earths, which are commonly found every where beſides, but which require ſome Skill to put together. A firſt Inventer does uſually fall upon his Secret by chance, and without ſeeking it; but a ſecond who ſeeks for what a firſt has found, rarely diſcovers it but by the Strength of Reaſon. Monſieur *Tſchirnhaus* gave Monſ. *Homberg* his Porcelain, or counterfeit *China* Ware, for ſome other Secrets in Chymiſtry which he received from him, and made him promiſe that whilſt he lived he would make no uſe of it.

After he was returned home he found himſelf continually ſurrounded with domeſtick Troubles, and his Life was one whole Sequel of Misfortunes. As the Health of the Soul depends upon that of the Mind, on which he had ſo much meditated, and as a Man of Philoſophy is afflicted with fewer Evils, or at leaſt with leſs painful Evils than another, he ſupported his with Conſtancy, and ſhew'd that which is ſeldom ſeen upon the like occaſions, the

Uſe of his Theory, and the Application of his Precepts. His Humour was not changed, nor ſo much as his Studies interrupted. He ſubmitted himſelf to that Providence which it is in vain to reſiſt, and infinitely more advantageous to ſubmit one ſelf to. At laſt, after having ſpent five Years in combating and conquering his Troubles, he fell ſick, perhaps becauſe one cannot conquer them ſo long together without being much weaken'd in ones turn. He was not afraid of the *Fever*, *Pthiſick*, *Dropſie* or *Gout*, becauſe he made ſure he had Medicines for them all, but he very much apprehended the *Stone*, being not ſo ſure, either of preventing or curing it eaſily. He had however found out a Preparation of Whey, which he thought very good, and which he has publiſhed in an Edition of his Book in *High-Dutch*. But that did not hinder him from being attacked in the Month of *September* 1678. with terrible Fits of the Gravel, followed with a Suppreſſion of Urine. The Phyſicians who did not find him tractable enough becauſe he underſtood ſo much of their Trade himſelf, left him quickly; whereupon he preſcribed to himſelf as he thought fit, and never loſt either his Conſtancy, Reſignation to Providence, or Uſe of his Reaſon to his Death, which happen'd upon the 11th of *October* following. His laſt Words were, *Triumph, Victory*. Probably he looked upon himſelf as Conqueror over the Evils of Humane Life.

He deſigned the following Winter to have made great Additions to his Book. He had devoted a Conſiderable part of his Patrimony to his pleaſure, that is to Learning. He propoſes in his Work, *The Plan of a Society compoſed of Men of Subſtance,*

ſtance, and Lovers of the Sciences, who were to furniſh other learned Men of leſſer Fortunes, with whatſoever ſhould be neceſſary to ſupport them in their Studies; and it is eaſie to ſee with what Pleaſure he would have born his Share in that Community; indeed he bore it without them, making it his Buſineſs to ſeek out Men that were Ingenious in the uſeful Sciences or Arts: He fetched them out of thoſe obſcure Corners, in which they are ordinarily hid, and became at the ſame time their Companion, Director and Benefactor: He has often taken upon himſelf both the Care and Charge of printing other Mens Books, from which he expected the Publick might reap any Advantage; among the reſt, Monſ. *Lemery*'s Courſe of *Chymiſtry*, which he had cauſed to be Tranſlated into *High-Dutch*, and that even without attributing to himſelf in the reſpective Prefaces, the Honour ſo juſtly due to him, and which another would not have ſlighted in leſs important Occaſions, unleſs you will ſay, that Vanity does not render 'em all equally Important; he was no leſs averſe to Oſtentation: He did good to his Enemies with Zeal, and without their Knowledge, which perhaps Chriſtianity does hardly require: He was not a Philoſopher on account of his rare Learning, and a common Man by his Paſſions and Weakneſſes; *true Philoſophy had penetrated even to his Heart, and had there eſtabliſhed that Pleaſing Tranquility, which is the greateſt, but leaſt ſought after of all Goods.*

His Place of *Foreign Aſſociate* was filled by Dr. Sloane, *Secretary of the Royal Society in* England.

The

The LIFE of *Monſieur* POUPART.

FRancis *Poupart* was born in the Country of *Manſe*, his Father was an honeſt Citizen, allied to the beſt Families in the Town, but had no Employment, and a large Stock of Children; he took great Care of their Education, ſo that one of em, whom he bred up to the Sea, raiſed himſelf by his own Merit, to the Command of a Man of War.

Our Monſieur *Poupart* perform'd his Studies with the *Fathers of the Oratory* of the *Manſe*: The Scholaſtick Philoſophy ſerved only to teach him that Men might Philoſophiſe, and inſpired him with the Deſire of it. He quickly fell upon the Works of *Deſcartes*, which gave him a noble Idea of Nature, and alſo a mighty Paſſion to Study it. He ſpent ſome Years at Home in this only Employment, being uncertain to what Profeſſion he ſhould turn himſelf; at laſt he declared for Phyſick. But wanting both Spiritual, as I may call it, and Temporal Aſſiſtance too in the *Manſe*, he came up to *Paris*, where it is much more eaſie to be ſupplied with both Kinds. He took upon him the Education of a Gentleman's Child for his Subſiſtance; but perceiving quickly that the Cares of ſuch an Employment took up all his Time, he abandoned it, chuſing rather to *Study* than *Live*; that is to ſay, to the end he might be entirely to himſelf and his Books, he reduced himſelf to a very ſtreight and inconvenient manner of Living.

We are not aſhamed to confeſs openly the mean Condition of our Brethren, nor to expoſe to the Eye of the Publick, *the Bag and Staff of a* Diogenes, tho' we live in an Age in which ſuch ſort of Philoſophers are leſs valued than ever, and in which certainly *they will not be viſited by Kings in their Tubs.*

Monſ. *Poupart* applied himſelf with great Induſtry to the Study of the Phyſicks, and particularly to *Natural Hiſtory*; which after all, is perhaps the only Phyſicks within our reach. A ſingular Taſt carried him to the Study of the *Inſects*, a kind of Animals ſo different from all the reſt, and ſo different among themſelves too, that *they make us Comprehend in general the infinite Diverſity of the Models upon which Nature may have formed other Animals for an Infinity of other Habitations.* He had both the Patience oftentimes ſufficiently painful, to obſerve them during all the neceſſary time, and the Art of Diſcovering their hidden Life, and the Skill of making, whenever it was poſſible, the nice Anatomy of theſe little Bodies. He carried his Obſervations to the Meetings at the late Abbot *Bourdelot*'s, where he was one of the principal Actors, they were printed in the *Journal des Sçavans*; witneſs his Diſſertation upon the *Leach*, which was very well received by the Naturaliſts; for it made known to them a Creature, which all the World fancied they underſtood before.

To accompliſh himſelf in Anatomy, he was deſirous to be employed in the Surgery of the Hoſpital called *Hotel Dieu*, and offered himſelf to be examined to that purpoſe; they interrogated him upon the moſt difficult Subjects, and by the Anſwers he made them, found that he was very expert in the Art of Surgery; ſo that they admitted him with Applauſe. But they were exceedingly ſurpriſed when he confeſſed to them that he knew no more of Surgery than only to let Blood, and that all the reſt was pure Speculation. They did not repent however of having received him, they judged him very Capable of gaining readily and perfectly the Practice of that Art which they were not able to Diſcover his Want of; and they inſtructed him with the ſame Pleaſure as Maſters do their brighteſt Scholars. He ſpent three Years in theſe Employments, after which he applied himſelf wholly to Phyſick; and as he did not ſeek to ſtreighten the Extent of it, he took in all that had relation to it, as Botany and Chymiſtry. He took his Doctor's Degree in the Univerſity of *Rheims.*

His thirſt after Knowledge could not be confined within the Bounds of his Profeſſion, as vaſt as they were. It was no extraordinary thing that the Philoſophy of *Deſcartes* ſhould engage him in a competent Knowledge of Geometry; but one can hardly believe that it ſhould have carried him as far as the Study of Architecture. Monſ. *de la Hire*, who profeſſes that Art, has obſerved him to be very Conſtant at his Lectures, and knowing him no otherwiſe, believed that he might be a Man that had ſome thoughts of applying himſelf to Building; nor did he ſo much as gueſs from the outward Appearances that thoſe Functions to which he might aſpire were very Sublime; but he was very much ſurpriſed, when at the reviving of the

Academy in 1699, all the Academiſts that had no Pupils having choſen their reſpective ones, he found Monſ. *Poupart* appearing at the Meetings, as *Pupil* of Monſ. *Mery* and *Anatomiſt*. The Society being then filled with a great Number of new Members, who either had no Works ready to be produced at the Meetings, or elſe had not Courage enough to produce 'em before ſuch redoubted Judges, Monſ. *Poupart* was the firſt of them all, who found himſelf in a Condition to ſpeak, and was Maſter of a noble Aſſurance to do it. He read a Diſcourſe about *Hermaphrodite Inſects*, which was a happy Omen of the Capacity of thoſe among the New ones, that were not yet known to the greateſt Number of the *Academiſts*.

We have ſeen ſince among theſe Volumes which the Academy has publiſhed every Year, his Hiſtory of the *Formica-leo*, that of the *Formica-pulex*, his Obſervation upon the Fiſh *Muſcles*, and ſeveral others leſs Important, or perhaps only leſs ſhort. He fell Sick in *October* 1709, and died in a few Days. He is thought to be the Author of a Book entitled, *The Compleat Surgery*; which is only a proper Collection of ſeveral other Tracts. If it be ſo, we ought to excuſe him for the Neceſſity he lay under of doing it, and at the ſame time applaud him for not Glorying in ſuch a Collection, of which he had a great number of Examples that might have tempted him.

The LIFE of *Monſieur* de CHAZELLES.

JOhn *Mathew de Chazelles* was born at *Lyons* the 24 *July* 1657. His Father was a ſubſtantial Merchant: He performed all his Studies in the great College of the Jeſuits in that City, after which he came to *Paris* in 1675, the Paſſion he had of being acquainted with Men of Merit carried him to the late Monſ. *du Hamel*, Secretary of the Academy, who on his part, did very much encourage all young Perſons of whom he could conceive any hopes. And he obſerved in him a great diſpoſition towards Aſtronomy; for the Young Man was already a Geometrician; He preſented him to Monſ. *Caſſini*, who took him along with him to the Obſervatory; a School in which *Hipparchus* and *Ptolomy* themſelves would not have ſcorned to have been Learners.

Theory and Practice always ſo different, are perhaps more ſo in the Buſineſs of Aſtronomy than of any other Art whatever, and the moſt Skilful Aſtronomer, who is only ſo in Books, when he comes to handle a *Teleſcope*, would be ſurprized to find that he had hitherto hardly ſeen any thing; Obſervations are a very fine and exceeding nice Work: Monſ. *de Chazelles* ſtudied this Art throughly, and at the ſame time made himſelf Maſter of all that vaſt Science of which it is the Foundation. He wrought under Monſ. *Caſſini*, upon that great Geographical Map in form of a *Plani-*

Planiſphere, which is upon *the Pavement of the Weſtern Tower of the Obſervatory*, and is Twenty ſeven Foot in Diameter. It was formed upon the Obſervations which the Academy had already made by the King's Order in different Parts of the World; and that which is moſt remarkable is, that it is in ſome manner Prophetical. It contained ſome very important and anticipated Corrections upon certain Conjectures of Monſ. *Caſſini*, which have been ſince verified by inconteſtable Obſervations.

In 1683, the Academy continued towards the North and towards the South the great Work of the Meridian begun in 1670. and Monſ. *Caſſini*, whoſe Province the South was, aſſociated Monſieur *de Chazelles* to himſelf in that Undertaking. They extended the Line as far as the Country of *Bourges*.

After having heard Monſ. *Caſſini*'s Leſſons at the Obſervatory during the Space of five Years, Monſ. *de Chazelles* could not but be himſelf a great Maſter. The great Duke *de Mortemar* took him to teach him the Mathematicks, and carried him into the Country of *Gennes* in 1684, and procured him the following Year a new Employment of Profeſſor of Hydrography for the Gallies at *Marſeilles*; for there had been a long time ſince, an old one filled by one of the Fathers Jeſuits, to whom it was neceſſary to give a Coadjutor, the Marine Affairs of *France* having been conſiderably increaſed.

Theſe Schools are kinds of little States, and hard enough to be managed. All the Subjects which compoſe them are in the Strength of their youth; Impetuous, Indocile, vehemently fond of Independance, Enemies almoſt irreconcileably to all Application, and that which is worſt of all, they are all Military Men; but their Maſter has no Military Power over 'em. Nevertheleſs Monſieur *de Chazelles* had the Reputation of being always reſpected, and even loved by theſe his redoubtable Subjects.

He had that ſteady and couragious ſweetneſs of Temper, which knows how to win Hearts with Dignity. The Succeſs he had here, encouraged him to undertake another new School of young Pilots, deſtined to Serve in the Gallies: From this School has proceeded, and does ſtill proceed daily, a great Number of good Seamen.

During the Summer of the Year 1686, the Gallies made four little Campaigns, or rather four little Tours, in which they only propoſed to perform their Exerciſes. Monſ. *de Chazelles* went with them each time, and kept his Schools upon the Sea. He ſhewed the Officers the Practical part of what they had only learnt before in Theory. He made likewiſe ſeveral Geometrical and Aſtronomical Obſervations, by which he was enabled to Publiſh afterwards a New Chart of the Coaſt of *Provence*.

We take no notice of two Campaigns, tho' more long and more conſiderable, which he made in 1687, and 1688. both of them produced a great number of Plans, and Draughts, either of *Ports* and *Roads* where he landed, or of Places that he had an opportunity of ſeeing. It is well known, that ſuch Draughts are not ſimple Curioſities, and that being depoſited in the Hands of Miniſters of

State, they become in certain Seaſons, Subjects of the moſt important Deliberations, which are regulated by them with ſo much the greater Certainty, as they have been performed by a good hand.

It is long ſince, that Experience, the ſupream Miſtreſs of all the Arts, has made a Diviſion between the two Kinds of the great Veſſels belonging to the Seas, and all the People of *Europe* have approved of it; to the *Ocean* it has allotted the *Frigates*, to the *Mediteranean* the *Gallies*. This latter draw too litte Water to withſtand the mighty Waves of the Ocean. But the former alſo have that eſſential Defect, that they are uſeleſs without the Winds; they are great Bodies, entirely depending on that foreign and unconſtant Soul, by which they are ſometimes quite forſaken. At the beginning of the laſt War, ſome of the Sea Officers, and Monſ. *de Chazelles* with them, were of opinion that we might make uſe of the Gallies upon the Ocean, that they might be there uſed to tow the Frigates, when the Wind either failed, or was againſt them; in a word, that they would render them indepentdant of the Winds, and conſequently much more uſeful than thoſe of the Enemy. They might likewiſe ſecure and defend our Weſtern Coaſts. Theſe ſort of bold Notions, provided they be contained within certain Bounds, proceed from a Courage of the Soul, uncommon, even among thoſe who have a brave Heart. Without ſuch boldneſs, a falſe Notion of Impoſſibility would mix it ſelf almoſt with every thing. As Monſieur *de Chazelles* had a great ſhare in the Project; he was ſent into the Weſt in *July* 1689, to view the Coaſt with reſpect to the Navigation of the Gallies; finally in the Year 1690, fifteen new built Gallies ſailed from *Rochefort* almoſt wholly upon his Word, and afforded a new Spectacle to the Ocean. They went as far as *Torbay* in *England*, and were made uſe of in the Landing at *Tinmouth*; Monſ. *de Chazelles* did there perform the Office of Engineer, very different from that of Profeſſor of Hydrography, tho' he was not deſtined to the War, and tho' it be not natural for a Soldier to be bred up in the Obſervatory; he ſhewed upon this and ſeveral other the like occaſions, all the Intrepidity which the profeſſion of Arms requires. The General Officers under whom he ſerved, have atteſted, that when they ſent him to view any of the Enemies Poſts, they could entirely rely upon the Report he made them. It happens but too often, that thoſe who are charged with theſe ſorts of Commiſſions, do not all of 'em either carry with them, or keep a very exact view of things. Monſ. *de Chazelles* was only originally a Man of Letters, but the Sciences themſelves had made him a Military Man; that which raiſes the Mind ought always to exalt the Soul too.

The Gallies after their Expedition returned to the Mouth of the *Seine*, into the Baſons of *Havre de Grace* and *Honfleur*, but they could not Winter there, becauſe it was neceſſary to drain thoſe Baſons from time to time, to avoid the Corruption of the Waters. Monſieur *de Chazelles* propoſed to carry the Gallies up as high as *Roüen*, all the Pilots found unſurmountable Difficulties in doing it, he alone maintained his Project, and he had acquired to himſelf great Truſt and Confidence, they believed him, and the Gallies went up very luckily. A great Capacity and Underſtanding do not alone ſuffice to render a Man bold enough to take upon himſelf any conſiderable Event; there muſt likewiſe concur a lively Zeal, to ſupport him under the Injuſtice of Mankind, always diſpoſed to withdraw their Approbation from every great Deſign, that is not attended with Succeſs.

Thus the Gallies winter'd at *Roüen*, and it was the Buſineſs of him that brought them thither, to preſerve them from all ſuch Accidents wherewith they might be threatned, in this their new and ſtrange Habitation. He therefore projected a new kind of Moorings, and a little row of Stakes, which ſecured them from the Froſts that they were to expect, and this he did at a ſmall Charge, whereas any other Method would have been very Expenſive.

Whilſt he was at *Roüen*, he digeſted the Obſervations he had been making upon the Weſtern Coaſts, and compoſed out of them eight particular Charts, accompanied with a *Portulan*, that is to ſay, an ample Deſcription of each *Port*, or the manner of coming into it, of the kind of Anchorage, of the Tides, of the Dangers, of the Diſcoveries, *&c.* Theſe Sorts of Works, when they are in their utmoſt Perfection, are of very great Value, becauſe the Practical Sciences are the leaſt advanced of any.

Two or three great Genius's may ſuffice to carry Theories very far in a ſhort time; but Practice proceeds much more ſlowly, becauſe it depends upon a great number of Hands, the greateſt part of which are the leaſt able. The new Charts of Monſ. *de Chazelles* were publiſhed in the *French Neptune*, in 1692, that ſame Year he made the Campaign of *Oneille*, and ſerved as Engineer at the Landing there.

In 1693. Monſ. *de Pontchartrain*, then Secretary of State for the Sea Affairs, and now Chancellor of *France*, having reſolved upon publiſhing a Second Volume of the *French Neptune*, which was to include the Mediterranean Sea; Monſ. *de Chazelles* propoſed to go and ſettle, by Aſtronomical Obſervations, the exact Poſition of the Principal Points of the *Levant*, and required but a Year for his whole Voyage. It would have been hard to have refuſed him a Favour for which he had ſo few Competitors; he parted, and ran thro' *Greece*, *Egypt* and *Turkey*, with the Quadrant and Teleſcope in his Hands. It is true, that this is only a continual Repetition of the ſame Operations, without acquiring new Lights; whereas the Learned Man that keeps in his Study, daily gets new ones with Extaſies and Tranſports of Pleaſure; but the more ſuch Pleaſure ſooths us, the more noble it is to Sacrifice it to the Service of the Publick, which is more benefited by ſome Facts well aſcertained, than by many ſhining Speculations.

This Voyage of Monſ. *de Chazelles*, afforded an important and long expected Diſcovery in Aſtronomy. It is neceſſary for the Perfection of this Science, that the Aſtronomers of all Ages ſhould tranſmit their Obſervations down to Poſterity, and give one another their helping hand; but to be able to make a right Uſe of the Labours of the Ancients, we muſt calculate for the Place where we are, what they calculated for their reſpective Places; and conſequently know exactly the Longitude and Latitude of thoſe Places. We muſt not too much depend upon the Ancients themſelves for it, becauſe we obſerve at preſent with ſuch Inſtruments, and ſo much Exactneſs, as they were incapable of, and which render all other Methods a little ſuſpicious. The Aſtronomers, whoſe Obſervations it was moſt neceſſary to compare with ours, were *Hypparchus*, *Ptolomy* and *Tycho-Brahé*; the two firſt were of *Alexandria* in *Egypt*, and they made that City the Capital of Aſtronomy. *Ticho* was in the Iſle of *Huene*, ſcituate in the *Baltick-Sea*, where he built that famous Obſervatory, which he called *Uraniburg*. The Academy, at the very Birth of it almoſt, had formed the noble Deſign of ſending Aſtronomers to *Alexandria* and *Uraniburg*, to carry on the Thread of the Work of thoſe great Men that had begun it there. But the Difficulties that were like to attend the Voyage of *Alexandria*, made them confine themſelves to that of *Uraniburg*, which Monſ. *Picard* was contented to undertake in 1671.

He there drew the Meridian of the Place, and was very much ſurpriſed to find it differ 18 min. from that laid down by *Tycho*, and which he could not have eſtabliſhed careleſly, becauſe it was neceſſary to fix a Term or Point, to which all his Obſervations might be referr'd; this would make one believe that the Meridians vary'd, that is to ſay, that the Earth does not always turn upon the ſame Poles; for if another Point becomes a Pole, all the Meridians that ought to paſs through that new Point, muſt neceſſarily have changed their Poſition. We ſee therefore of how great Importance it is to the Aſtronomers, to make themſelves certain either of the Variation, or of the Invariability of the Poles of the Earth, and of the Meridians.

Monſieur *de Chazelles* being in *Egypt*, meaſured the *Pyramids*, and found that the four Sides of the biggeſt, were exactly oppoſed to the four Regions of the World. Now as this ſo exact Oppoſition ought, according to all poſſible Appearances, to have been affected by thoſe who raiſed this great Maſs of Stones above 3000 Years ago; it follows, that during ſuch a long ſpace of time, nothing in the Heavens had varied in this reſpect, or which is the ſame thing, in the Poles of the Earth, or in the Meridians. Can one imagine that *Tycho*, ſo able and ſo nice an Obſerver, did draw his Meridian wrong, and that the Ancient *Egyptians*, ſo dull in theſe Matters at leaſt, drew theirs right? The Invariability of the Meridians has been yet further confirmed, by that which Monſ. *Caſſini* drew in the Year 1655, in the Church of *St. Petronia* at *Bologna.*

Monſieur *de Chazelles* brought back likewiſe from his Voyage into the Levant, all that the Academy deſired to know concerning the Poſition of *Alexandria.* Wherefore Monſ. *de Pontchartrain* thought there was due to him a Place in that Society, to which his Labours had been ſo uſeful. He was accordingly admitted in 1695, and then returned to *Marſeilles* to reſume his former Functions.

All the reſt of his Life was little more than a perpetual Repetition of what we have hitherto ſeen; Campaigns by Sea almoſt every Year, either in War or Peace, ſome of 'em only conſiderable (as that of the Year 1697, in which *Barcelona* was ſurrender'd) from the Poſitions he took of all the Places he ſaw, from the Draughts he made, from the

Functions of Engineer which he often performed, and with Honour too, and at laſt, from a peaceful Return to his School at *Marſeilles*. He did not deſpiſe this latter, becauſe he had been employed upon more ſhining Occaſions, nor would he ever think of leaving it. *The greateſt Souls are ſuch as adapt themſelves beſt to the preſent Situation, and exhauſt themſelves leaſt in remote and future Schemes.*

In the Year 1700, when Monſ. *Caſſini*, by the Kings order, went to continue towards the South, the Meridian forſaken, in 1683, Monſ. *de Chazelles* was appointed to go along with him, but did not overtake him till he came to *Rhodes*, and there Monſ. *de Chazelles* applyed himſelf ſo earneſtly to that Work during the worſt Seaſon of the Year, that his Health began to be conſiderably impaired by it.

The Line having been carried as far as the Frontiers of *Spain*, he returned to *Paris* in 1701, where he was Sick or Languiſhing above a Year. It was then he communicated to the Academy the vaſt Deſign he had projected of a general *Portulan* for the Mediterranean. One may conclude, that in the Geographical and Hydrographical Maps of the three Quarters of the Globe, there is as yet but an imperfect Sketch taken of the Earth; and that even in *Europe* it ſelf, the other Quarter, it is far from being quite finiſhed, or very near it, tho' there has been a great deal of Pains taken in it.

Notwithſtanding a great many diſtracting Cares, and his Infirmities too, the greateſt of all Cares, Monſ. *de Chazelles* would not loſe ſight of his Gallies wandering in the Ocean. Being at *Paris* in 1702, he propoſed that they ſhould lie dry in all the Havens where there was Tide enough to carry them in, by that means he trebled the number of Occaſions in which they might be employed. They tried his Project at *Ambleteuſe* upon two Gallies, which they ran aſhore, and it bore it fifteen Days without any Inconvenience. On the contrary, it afforded a very great Convenience of cleaning them. *One muſt be bold in all Projects, but the Difficulty is to be bold with Diſcretion*, which is next to reconciling Contradictions.

The Nine laſt Years of the Life of Monſieur *de Chazelles*, tho' as laborious as all the reſt, were almoſt always languiſhing, and his Health continually impairing. At laſt he was ſiezed with a Malignant Fever, which he ſlighted at the beginning, either from the habitude of Suffering, or from the little opinion he had of Phyſick, to which he prefer'd the ſtrength and help of Nature. Finally, he died the 16*th* of *January* 1710, in the Arms of Father *Laval* a Jeſuit, his Collegue in Hydrography, and his intimate Friend. *When two Men are Friends in Poſts that naturally makes them Rivals; one need not require any other Proofs of Equity, Sincerity, or even of Generoſity.* To theſe good Qualities, and all the reſt which we have already repreſented, Monſ. *de Chazelles* always joyned *a great ſtock of Religion, which only ſecures and ſtrengthens all other Virtues.*

His place of *Aſſociate Academiſt* was filled by Monſieur *Ozanam.*

The LIFE *of Monſieur* Guglielmini.

D*Ominicus Guglielmini* was born in *Bologna*, of a good Family, 27*th September* 1655. He Studied the Mathematicks under Monſ. *Geminiano Montanari* a *Modeneſe*, and Phyſick under the Illuſtrious *Malpighi*. He embraced theſe two Sorts of Studies at the ſame time, and with the ſame Facility, as a Man born with happy Diſpoſitious would have applied himſelf to one only, and was as much beloved by both his Maſters, as if each alone had had the Honour of his Education.

In 1676, there appeared in moſt parts of *Italy* a Meteor as luminous as the Moon at full; Monſ. *Montanari* compoſed a little Treatiſe about it, entitled, *Fiamma volante*, wherein, by the Obſervations he had received from ſeveral Parts, he enquired Geometrically what was the Line of Motion of the ſaid Meteor, its Diſtance from the Earth, and its Bigneſs. According to his Computation, its diſtance was fifteen middling French Leagues, which is an extraordinary Heighth for this kind of Fires. Monſ. *Cavina*, who had obſerved the ſaid Phenomenon at *Faenza*, made a very different Calculation of it; the Heighth where he placed it, for inſtance, was treble to that of Monſ. *Montanari*, and beſides this latter in his Book, having ſlighted the *Obſervations* of *Faenza*, not by rejecting them with Contempt, but in ſaying, that he was very ſorry to find them ſo different from all the reſt, and that probably the Miſtake proceeded from thoſe that had communicated them, and to whom there had been too much Credit given; this Complaiſant manner did not hinder Monſ. *Cavina* from returning a ſharp Anſwer to Monſieur *Montanari*, who ſeeing that their Diſpute was like to degenerate into Reflections and Injuries, had bravery enough to declare publickly, that he renounced it. Monſ. *Guglielmini*, who was then but 21 Years old, and as zealous a Diſciple of *Montanari* as the late Monſ. *Viviani* was of the famous *Galileo*, (for theſe ſort of Attachments ſeemed to be ſtrongeſt in *Italy*) deſired his Maſters leave to anſwer for him; Monſ. *Montanari* refuſed him, leaſt his Adverſary ſhould think that the Maſter was concealed under the Scholar's Name; Monſieur *Guglielmini* however prevailed at laſt, and got leave to maintain ſome Publick Theſis, where Monſ. *Montanari* ſhould not be preſent, and where Monſ. *Cavina*, whoſe Opinion was attacked, ſhould be invited, and ſtaid for during a certain time; he came not, but treated the Challenge as a Duel would be treated in *France*, and he was in the right of it, it ſeems, for Monſ. *Guglielmini*, tho' he declares that he was not yet got through the *Conick Sections*, overthrew his Enemy in the Science of Geometry; there were a good many Writings paſſed between them, and ſome of 'em much larger than the Caſe in reality required; *two or three Pages might have ſufficed to unfold the Truth, but Mens Paſſions ſwell them into great Bodies.*

Monſieur *Guglielmini* took his Degree of Doctor of Phyſick in the Univerſity of *Bologna* in 1678, but in the midſt of that Application and Study, which ſuch a laborious Profeſſion requires, a new Phenomenon that appeared in the Heavens called him away again for a while to the Mathematicks. It was the Comet of 1680, and 1681, which, by I know not what particular Fate, put the learned World in a greater Ferment than any other had done. The Sentiments of thoſe who maintain that Comets are Eternal Bodies as well as Planets, had been attacked by Monſ. *Montanari* upon this Ground, that this laſt Comet which diſappeared at the end of *February*, 1681, was not then ſo very remote from the Earth, as to diſappear on account of its diſtance only, and conſequently that there muſt have happened ſome natural Diſſolution; this reaſon, which did not carry the Force of Demonſtration with it, appeared ſo however in ſome ſort to Monſ. *Guglielmini*, becauſe it came from a Maſter that was ſo dear to him, and it put him upon looking out for an Hypotheſis, to explain the Generation of Comets. He fancied one that was ſingular enough, upon which he formed a Work, entitled, *De Cometarum natura & ortu, Epiſtolica Diſſertatio Bononiæ*, 1681. He allows very great *Vortexes* to the *Planets*, ſo that thoſe, for inſtance, of *Jupiter* and *Saturn*, whoſe Centres are diſtant 165 Millions of Leagues, when they come as near one another as poſſible, may croſs each other towards their Extremities. In this Interfering and Embaraſſment of the Matter of the two *Vortices*, there is form'd, by vertue of the oppoſite Motions, a new *Vortex*, of which the greateſt Parts (for the Heavenly Matter is not all Homogenious) ſubſide, and take the place of the Centre, producing a new ſolid Body, which is the Head of the Comet.

We ſhall not relate either the Proofs or the Difficulties of this Syſtem; the Author himſelf declaring, that he does not affirm it to be true, or even probable, but only proper to explain the Facts, and he propoſes it with ſuch a Modeſty, as attones for its Weakneſs, and diſarms the Criticks.

He gave new Teſtimonies of his skill in Aſtronomy, by the Obſervation he made at *Bologna* upon an Eclipſe of the Sun, that happened the 12*th* of *July*, 1684; and which he publiſhed in Latin tho ſame Year.

The Merit of Monſ. *Guglielmini* was confeſſed even in his own Country: The Senate of *Bologna* made him Firſt Profeſſor of the Mathematicks, and in the Year 1686, gave him the general Superintendency of the Waters of that State. Travellers tell us, that in *Perſia* the Office of Superintendent of the Waters is one of the moſt conſiderable, becauſe of the dryneſs of the Country, and the difficulty of Watering all ſufficiently and equally; by a quite contrary reaſon, this Employment is of the ſame Importance in the *Bologneſe*, and in general throughout *Lombardy*, where the great Quantity and Diſpoſition of the Rivers and Canals, otherwiſe ſo profitable to the Country, may nevertheleſs produce great Inconveniencies, unleſs they be continually upon the watch, and that with underſtanding Eyes too.

Monſ. *Guglielmini* had that uncommon Scrupuloſity of conſidering his Employment, not like one of thoſe Commiſſions which are always well enough diſcharged by a general Knowledge of the Affair, and in which it is ſufficient if one ſpoils nothing; but as a very ſerious Engagement, which was to engroſs all his Thoughts, and by which he was to ſerve the Publick with the utmoſt Exactneſs.

Wherefore in the Year 1690, he publiſhed the firſt, and in 1691 the ſecond part of a Treatiſe of *Hydroſtaticks*, entitled, *Aquarum fluentium menſura, novâ Methodo inquiſita*; and Dedicated it to the Senate of *Bologna*. His fundamental Principle, which is likewiſe that of all the Modern Philoſophers, is, *that the Swiftneſſes of a Water proceeding from a vertical or inclined Tube, are at each inſtant, as the Roots of the Heights of its ſuperior Surface*, which neceſſarily introduces the Parabola in this whole Matter. Even when the Water runs thorow a Horizontal Canal, which may be, provided that it has an Iſſue to diſcharge it ſelf, the Principle is ſtill the ſame, becauſe the Upper Water preſſing upon the Lower, communicates to it a Swiftneſs proportionable to its Depth.

To find Geometrically, in a Horizontal Canal, the middle Swiftneſs between that of the Bottom, which is the greateſt, and that of the Superfices, which is the leaſt, we ſee preſently by the ſquaring of the Parabola, that that Swiftneſs is always in proportion to the Bottom, as Two to Three, and that it is always placed at $\frac{4}{9}$ of the Depth of the Canal, divided from the Top to the Bottom.

When one has made a Fundamental Experiment upon the Swifneſs of the Water; as for Example, that of Monſ. *Guglielmini*, by which he found that a Water deſcending the Depth of one Foot of *Bologna*, ran in one Minute, two hundred and ſixteen Foot, five Inches, with an equal Motion, one knows then its Swiftneſs for all poſſible Falls; and he has calculated a Table for that purpoſe, which he does not carry beyond thirty Foot of Deſcent, becauſe the greateſt *Rivers* in *Europe* do not exceed that Depth. If one would meaſure the Quantity of Water, which paſſes in one minute thorow a Horizontal Canal, knowing that its middle Swiftneſs is as $\frac{4}{9}$ of its Depth, one muſt reduce thoſe $\frac{4}{9}$ into Feet and Inches. Then one finds by the Table, what Fall or Preſſure is requiſite to ſuch a Depth, that's the middle Swiftneſs of the Water, and multiplying it by the Breadth and Depth of the Canal, one has the Quantity of the Water demanded. Monſ. *Guglielmini* finds by this Method, that the *Danube*, ſuppoſing it Horizontal at its Mouth (as are almoſt all the great Rivers at leaſt ſenſibly) diſcharges into the *Euxine* Sea in one minute, near forty two Millions of *Bologneſe* Cubical Feet of Water.

For the inclined Canals there is only required a little more Calculation, and the Knowledge of the Angle of Inclination of the Canal, after which all the reſt is alike.

This is the general Idea of the whole Work; it is very exact and methodical. Only perhaps it may appear a little prolix to ſuch as have the Taſt and Habitude of that Algebraical Brevity, which, in the Buſineſs of the Mathematicks, may be properly compared to what we call a cloſe Stile in Eloquence and Poetry: But every Author writes chiefly for his own Country; and tho' *Italy* may be accounted, at leaſt as to *Europe*, the Cradle of *Algebra*, that Science had not yet made any great Progreſs in the Time of Monſ. *Guglielmini*, but flouriſhed much more in the Northen Climates.

The Tranſactions of *Leipſic* for the Year 1691, having given ſome account of this Book about the *Admeaſurement* of the *Waters*, Monſ. *Papin* made ſome Remarks and Objections upon the Extract that he there met with, and cauſed them to be inſerted into the ſame Journal. Of this Monſieur *Guglielmini* received ſome general Notice by Letters from Monſ. *Leibnitz*, before thoſe Tranſactions could reach *Italy.* At the Name of Monſ. *Papin*, he began to fear he had been miſtaken; for it is not to be doubted of, after the Confeſſion he made of it himſelf, unleſs thoſe who underſtand true Glory, will look upon ſo honourable a Confeſſion as a little ſuſpicious. He received at laſt the Tranſactions of *Leipſic*, and took Courage thereupon, and writ to Monſ. *Leibnitz*, to make him Judge of the Difference.

Monſieur *Papin* believed, and pretended he could demonſtrate, that the Water that comes out of a Tube always full, has but half as much Swiftneſs as the firſt Water which comes out of the ſame Tube emptying it ſelf: His reaſon was, that in the former Caſe the Water has only an equal and uniform Motion, whereas in the Second it has an accelerated Motion, ſince it falls, or is ſuppoſed to fall; Monſieur *Guglielmini* confuted that Hypotheſis with all the decency and civility which became a Man who ſincerely believed himſelf capable of Erring. It appears by his whole Letter, that the Victory was entirely on his Side; and yet it appears likewiſe, that there was ſomething in that matter which he had not unravelled, and which eſcaped his Accuracy. The Swiftneſſes of Water are as the Roots of the Depth, there being exactly between them the ſame Relation as between the Swiftneſſes of heavy Bodies deſcending; the two Adverſaries, and all the other Philoſophers, had imbibed this very natural Idea, that the Swiftneſſes of Water depend upon an Acceleration occaſion'd by a Fall; but we have ſhewn, after Monſieur *Varignon*, in our Hiſtory of 1703, that as natural as this Idea is, it is not true; and that there is another Principle of this relation of the Swiftneſſes of the Water quite different from the Acceleration, and at the ſame time ſo plain and ſimple, that it would not do much Honour to the Inventer of it, if it had not been ſo long concealed from the moſt able Geometricians. For want of knowing this Monſ. *Guglielmini* could not avoid certain Difficulties, out of which he endeavours to extricate himſelf by the Preſſures of the Air. *It does not ſuffice to have diſcover'd a Truth, but one muſt likewiſe, if one would carry it a good way, trace its true Cauſe; otherwiſe the falſe Cauſe of a Truth begets Errors, its Natural Production.* Monſ. *Guglielmini*'s Letter to Monſ. *Leibnitz* was followed with another in 1691, directed to Monſieur *Magliabecchi*, about the *Syphons*; becauſe he had found in the Acts of *Leipſic*, that Monſieur *Papin*, in examining a *Syphon* made at *Wirtemberg*, had made uſe of his falſe Propoſition. Thoſe two Letters were printed under the Title of *Epiſtolæ duæ Hydroſtaticæ.*

About that time there aroſe a Difference between the Cities of *Bologna* and *Ferrara*; the chief Queſtion was, to know whether the Courſe of the *Reno* ſhould be turned into the *Po*? The Pope, who was Sovereign of both thoſe States, ſent the Cardinals *Dada* and *Barbarin* to decide that Affair.

Bologna referr'd its Concern to Monſ. *Guglielmini*, the ſole Perſon capable of tranſacting it. The two Cardinals with whom he treated, conceived ſo great an opinion of his Capacity, that they employed him not only for the Waters of the *Bologneſe*, but likewiſe for thoſe of the *Ferrareſe*, and of the Territory of *Ravenna*, and engaged him in Plans of different Works, either uſeful or neceſſary. But it then happen'd to him as we have already ſaid it did to Monſ. *Viviani* on the like Occaſion, for Projects which only relate to the Publick, are ſeldom put in Execution.

As Monſ. *Guglielmini* had carried the Science of *Waters* farther than any one elſe, at leaſt in *Italy*, and as he had formed a Science almoſt new about it, the City of *Bologna*, in the Year 1694, founded a New Chair of Profeſſor of *Hydrometry* in its Univerſity, and gave it to him. The Name of *Hydrometry* was as new as the Office, and both of them will always bring to mind the Name of the Man who render'd this Eſtabliſhment neceſſary.

He allowed himſelf however to be diverted ſometimes from the ſtudy of the Waters, upon Occaſions in which it had been difficult to reſiſt the Call of other Sciences. When Monſieur *Caſſini* return'd to *Bologna* in 1695, and mended the famous *Meridian*, which he had drawn there forty Years before, in the Church of St. *Petronia*, and which ſeveral Accidents had changed, Monſ. *Guglielmini* aſſiſted him in that great Philoſophical Labour; and did likewiſe print an Account of the Operations that had been made for the Conſtruction and Verification of that prodigious Inſtrument.

ſtrument. He made uſe of it ſince during ſeveral Years, in obſerving the Motions of the Sun and Moon.

In 1697, he publiſhed his great Work of *the Nature of Rivers* in *Italian*, which paſſes for his Maſter-piece, and Dedicated it to the Abbot *Bignon*, who the Year before had cauſed him to be choſe a Member of the *Royal Academy of Sciences*, and whoſe Name and Merit, without ſuch particular Favours, has often induced even Foreign learned Men to pay him the like Homage.

The Subject of his Preface is upon the neceſſity of reducing Phyſicks to a Geometrical Certainty, and upon the Difficulty, often unſurmountable, of introducing the ſimple Idea's of Geometry into ſo complicated a Science as that of Natural Philoſophy.

A common Naturaliſt will not doubt perhaps that he does not ſufficiently underſtand the Nature of Rivers; but after having read Monſ. *Guglielmini*'s Book, he will be convinced that he knew nothing of it. We will only give you here a general Sketch of that Treatiſe, and leave you to judge what the different Combinations of Principles and Applications to particular Caſes may produce.

Rivers near their Springs commonly deſcend from ſome Mountains, and there they take their Swiftneſs from the acceleration of their Fall; but in proportion to their Diſtance from the Spring, that Swiftneſs grows leſs, becauſe the Water always rubs againſt the Bottom and the Sides of its Channel, becauſe it met with ſeveral Obſtacles in its way, and laſtly, becauſe when it glides along the Plains, its deſcent always decreaſes, and it inclines more to-

wards

wards the Horizon. The *Reno* is ſcarce inclined to it above fifty two Seconds towards the end of its Courſe. If the Swiftneſs acquired by the Fall ſhould be quite loſt, which may happen ſometimes by meeting with ſeveral Obſtacles, and the Courſe of the River become altogether Horizontal, there is nothing but the Depth of it, or the preſſure always proportioned to the Depth, that can reſtore its Swiftneſs and make it run. Happily this reſource increaſes according to the Want of it; for in proportion to the loſs of the Swiftneſs acquired by the Fall, the Water riſes and increaſes in Depth.

The upper Parts of the Water of a River, which do not touch the Banks, may run only by vertue of the Declivity, tho' that be never ſo ſmall; for being hinder'd by no Obſtacle, they may be nicely ſenſible, as one may ſay, of the leaſt difference of the Level; but the lower Parts, which rub againſt the bottom, could not be ſufficiently moved by ſo ſmall a Declivity, nor would they run without the concurrent preſſure of the upper Parts.

The natural Viſcoſity of the Parts of Water, and a kind of Tenacity which they have with one another, is the cauſe that the lower Parts being moved by the Depth, draw the upper with them, which in a Horizontal Channel would not have had any Motion of themſelves, or would have had but a little in a Channel but little inclined. Thus the lower do in this caſe reſtore to the upper ſome part of the Motion they had received from them. From thence it likewiſe happens, that very often the greateſt Swiftneſs of a River is about the middle of its Depth; for the Parts in the middle have the advantage of being preſſed by the half of the Water above them, and of being free from the Friction of the Bottom.

To know whether the Water of a River that is almoſt Horizontal, runs by the Swiftneſs acquired from its Fall, or by the preſſure of the upper Parts, you need only oppoſe to its Courſe a perpendicular Obſtacle; for if the Water raiſes it ſelf ſuddenly againſt the Obſtacle, then it ran by vertue of its Deſcent; but if it ſtops a while, then the preſſure was the Cauſe of its Motion.

Rivers do almoſt always make their own Bed, in which, if there be at firſt a great Declivity towards the Bottom, the Water that will conſequently have a greater fall and ſtrength, will carry away the moſt exalted part of the Ground, and by that means render the bottom more even and horizontal; 'tis under the Stream of the Water that the greateſt ſtrength of Friction or of wearing lies, and conſequently 'tis there that the Bottom is render'd moſt hollow. The Water that makes its Bed moſt horizontal becomes ſo likewiſe it ſelf, and thereby has leſs Strength of wearing; and that Strength being at laſt ſo far diminiſhed, as to be only equal to the reſiſtance of the Bottom, it is reduced to a ſtate of Conſiſtance, at leaſt for a conſiderable while. The Bottoms that are compoſed of Chalk reſiſt more than thoſe that are of Sand or Mud.

On the other hand, the Water wears away and undermines its Sides, and with ſo much the more force, as by the Direction of its Courſe it finds them more perpendicular. Wherefore by wearing and rubbing them, it tends to render them more parallel to its Courſe, and when it is come as far as it can towards that Point, it has no farther action over them in that reſpect. At the ſame time that the Water wears away its Banks or Sides, it enlarges its Bed, but loſes in its depth and ſtrength proportionably, 'till at laſt there is an *Equilibrium* between the ſtrength of the Water, and the reſiſtance of the Sides, and then its Bounds are ſettled.

It is plain by Experience that theſe Equilibriums are real, ſince Rivers do not dig and enlarge their Channel for ever.

The contrary of what we have ſaid does likewiſe happen; Rivers whoſe Waters are troubled and muddy, raiſe their Bed by the ſubſiding of the foreign Matter mixed with them, when they can no longer ſupport it, they likewiſe narrow their Borders by the Acceſſion and Incruſtation of the ſame Matter on the Sides of them. This Matter being driven far from the Stream of the Water, by reaſon of its little Motion, may likewiſe contribute towards the making of Banks; theſe contrary Effects meeting almoſt always together, and combining very differently, according to the particular Degrees of them, it is not eaſie to gueſs at the Reſult; nevertheleſs one muſt find out, as exactly as poſſible, this entangled Combination, if one has to do with a River of which for inſtance, one intends to turn the Courſe. One may conclude that it will always act according to its Nature, and that it will accomodate it ſelf with a Bed, and work out ſuch a Courſe as will be agreeable to it. Monſ. *Guglielmini* relates, that at the beginning of the laſt Century, the River

Lamone, which fell into the *Po di Primaro*, was turned from it; to the end that it might diſcharge it ſelf alone into the *Adriatick* Gulph.

It happen'd that the *Lamone* being become more weak when it had only its own Waters, raiſed its Bed in ſuch a manner by the ſubſiding of its Mud and Slime, that it was higher than the *Po* in its deepeſt places, and ſtood in need of very high Banks.

The Neceſſity of making Banks or Dykes to Rivers may ariſe from ſeveral Cauſes. Theſe are the Principal. Firſt, if the Rivers are winding, the Banks which ſtop them at the Point of their ſinuoſity or winding, raiſe their Waters, and by that means contribute to their Strength of undermining and piercing the ſaid Banks, and ſo to the Overflowing of the Country. Secondly, the Banks may be weak, as are thoſe which Rivers make for themſelves by the Depoſition of the Foreign Mud which they carry along with them; ſuch are the Banks of moſt of the Rivers in *Lombardy*, where not only the Dykes, but even the Plains themſelves have been formed by the Rivers. It is good to obſerve that the Plains thus made by *Alluvion*, are higheſt next the Sides of the Rivers that produce them, and always afterwards lower. Thirdly, the Rivers that run upon a very courſe Gravel are Subject to bring great heaps of it together, which at laſt help to turn their Courſe. They are moſt commonly ungovernable; witneſs the *Loire*: Whereas, thoſe which have a Bottom of light Sand are much more eaſily managed.

A ſmall River may fall into a greater without increaſing either its Breadth or Depth; this appearing Paradox, is founded upon the Poſſibility that the ſmall River may do nothing more but put in motion the Waters of the greater, next the Banks which were ſtagnant before, and likewiſe increaſe the Swiftneſs of the Stream; and that it does to the whole, in proportion as it augments the Quantity of the Water. That Branch of the *Po*, that belongs to the State of *Venice*, has ſwallowed up the two other of *Ferrara* and *Panaro*, without any increaſe of its Bed.

We muſt account in the ſame manner proportionably for all the Additions to other Rivers, and in general for every new Augmentation of Water, which at the ſame time increaſes the Swiftneſs of the Stream.

If a River which preſents it ſelf to fall into another River, or into the Sea, be not ſtrong enough to ſurmount the Reſiſtance it meets with, it would preſently ſwell, either becauſe its Swiftneſs is diminiſhed, or becauſe the Waters that ſhould have received it are diſgorged back again into it; but by that very ſwelling it would require a Strength ſufficient to make its Way; nay, it would even receive it from the very Oppoſition it met with.

A River that falls perpendicularly into another, or even againſt its Current, will by little and little be turned away from that Direction by the River which receives it, and obliged to make it ſelf a new Bed towards its Mouth.

The Union of two Rivers occaſions a ſwifter Stream afterwards; Firſt, becauſe inſtead of rubbing againſt four Banks, they have only two to ſurmount; Secondly, becauſe the Stream being at a greater diſtance from the Banks moves more ſwiftly;

ſwiftly, and *Laſtly*, becauſe a greater quantity of Water moved with more Swiftneſs deepens the Bottom more, and leſſens the former Breadth. From hence it likewiſe proceeds, that united Rivers occupy a leſſer ſpace of the Earth's Surface, ſuffer more eaſily the lower Meadows to diſcharge their ſuperfluous Waters into them, and have leſs occaſion for Dykes to fence againſt their Inundation. Theſe Advantages are ſuch as Monſ. *Guglielmini* thinks worthy to have been premeditated by Nature, when ſhe made the Union of Rivers ſo common.

Theſe are the moſt general Principles of his Book about the *Nature* of *Rivers*, and they are applied by the Author to every thing that he calls *the Architecture of the Waters*, that is to ſay, to all ſuch Works as have the Waters for their Objects, to the new Communications of Rivers, to Canals that are made for Watering the Lands that ſtand in need of 'em, to Sluices, to draining of Fens and Marſhes, *&c.*

This Book, an Original in its kind, made a great Noiſe. *Cremona*, *Mantoua*, and ſome other Cities, had recourſe to the famous Architect of the Waters; He order'd the Works that were neceſſary for them; but his Art ſhined chiefly in the Banks that he made for the *Po* below *Piacenza*, where this River made great Havock, and threatned much more.

The Common-wealth of *Venice* envying the Happineſs of *Bologna*, called him in the Year 1698, to the Profeſſorſhip of the Mathematicks at *Padoua*. However his own Country to keep him hers as much as 'twas poſſible, and that ſhe might always boaſt that he belonged to her, thought fit to continue to him the Title of Profeſſor in her Univerſity, with the ſame Allowance as before.

Venice would not ſuffer him to remain long in the peaceful Exerciſes and Shade of an Univerſity. In 1700, ſhe ſent him into *Dalmatia*, to repair the Ruins of *Caſtelnovo*, and ſome time after into the Country of *Friuli*, where a moſt impetuous Torrent, that had already deſtroyed ſeveral Villages, was going to fall upon the important Fortreſs of *Palma*. Monſ. *Guglielmini* diſcovers ſo much love for the Publick Welfare in all his Works, even in thoſe where the dry Mathematicks predominate, that all theſe Voyages, and all theſe Fatigues, may be reckoned by us among the pleaſant Parts of his Life.

Perhaps the Zeal he had of being uſeful to the Publick all manner of ways, made him return again to Phyſick, which he ſeemed before to have ſacrificed to the Mathematicks. In 1702, he took the Chair of Profeſſor of Theoretical Phyſick at *Padoua*, and left that which he had before. A Diſſertation that he had publiſhed the foregoing Year, *De Sanguinis naturâ & conſtitutione*, might have been eſteemed a Preſage of this Change; at leaſt was it a Proof both of his great Labour, and of the great Extent of his Learning.

But he gave a much more ſhining one, by his Book, entitled, *De Salibus Diſſertatio Epoſtolaris Phyſica Medico-Mechanica*, Printed at *Venice* in 1705. It is not a long time ago that all the Treatiſes upon Chymiſtry were accounted no more than ſo many ſorts of Poetical Fictions, lively, animated, and agreeable to the Imagination, but unintelligible and unſupportable by Reaſon. Sound Philoſophy coming upon the Stage, has undertook to reduce to plain Corpuſculary Mechanicks, that Chymiſtry ſo myſterious, and in ſome Senſe ſo proud of its own Obſcurity. However it muſt be confeſſed, that there ſtill remain with ſome Authors, Traces of its ancient Poetry, Unions almoſt Voluntary, Combats only founded upon certain Diſagreements, and ſome other Notions that are by no means conſiſtent with the rigid Mechanicks. Monſieur *Guglielmini* ſeems to have ſtood extreamly upon his Guard to prevent theſe Whimſies from creeping into his Chymical Diſſertation; he there reduces every thing with Severity to the Rules of exact and clear Phyſicks; and that he may yet more perfectly purge his Chymiſtry, and carry of all its Filth, he mixes it with Geometry. The Ground of the whole Work is, that the firſt Principles of Common *Salt*, *Vitriol*, *Allum*, *&* *Nitre*, conſiſt, from their original Creation, of fixed and unalterable Principles, and are indiviſible with reſpect to the determinate Force or Strength that is in Matter; the Primitive Figure of the Common Salt is a little *Cube*, Salt of Vitrol *a Rhomboïd Parallelepipedon*, Nitre a *Priſm*, whoſe Baſis is an *Equilateral Triangle*, and Allum a *Quadrangular Pyramid.* From theſe firſt Figures proceed thoſe which they conſtantly affect in their Cryſtalizations, provided they are kept as free as poſſible from all Foreign Mixtures.

In treating about the Action of Salts, Monſ. *Guglielmini* examines Geometrically and Mechanically the Properties of theſe Figures, with reſpect to Motion, and comes to a Detail of them, curious enough and very new, in a Diſcourſe of Chymiſtry.

He does not relate either the Experiments or new Obſervations he has made; he eſtabliſhes his Syſtem upon thoſe of the moſt famous Authors, among whom he often quotes in the Academy, Meſſieurs *Homberg*, *Lemery*, *Bouldue*, and *Geoffroy*; in a word, 'tis not ſo much Chymiſtry as Geometry that prevails in this Treatiſe, and which is yet more valuable, the very Spirit of Geometry.

When the Impreſſion of this Book was finiſhed, the Hiſtory of the Academy for the Year 1702, fell into his Hands. He there met with an Opinion of Monſ. *Homberg* quite different from his own, *viz.* That the conſtant Figures of Acid Salts in their Cryſtalizations do not proceed from the firſt Particles of which they are compoſed, but from *Alcali's* with which they are united. He confeſſes he was afraid that the Authority of ſo great a Chymiſt might have alone ſufficed to overturn his whole Syſtem, and he made haſt to ſecure it by an Anſwer, which by being very civil and obliging, loſes nothing of its Strength, nay perhaps acquires more.

He compoſed two other Phyſical Works, one entitled, *Exercitatio de Idearum vitiis, correctione, & uſu ad ſtatuendam & inquirendam morborum naturam*, in 1707, and the other *De principio Sulphureo*, in 1710; and that which is very glorious for him is, that the Date of the latter Work is the ſame with that of his Death. His whole Life was devoted to the Sciences, which thoſe who love with leſs Zeal than he, may reproach him for as an Exceſs; and indeed it was ſuch an Exceſs as deſtroyed a very robuſt Conſtitution, and yet it muſt not be condemned but with Reſpect. He had that outward Appearance which is uſually the reſult of Lives ſpent in a Cloſet, ſomething a little uncouth and wild, at leaſt to ſuch as were not accuſtomed to him; *he deſpiſed* as the *Journal des Sçavans* of *Italy* informs us, *that Superficial Politeneſs with which the World is ſatisfied, but he had formed to himſelf one of another kind that reſided altogether in his Heart.*

His Place of *Foreign Aſſociate* in the Academy was filled by the Earl of *Pembroke.*

The LIFE *of Monſieur* CARREE.

L*Ewis Carrée* was born the 26th of *July* 1663. He was the Son of an honeſt Farmer of *Cloſontaine* near *Nanguis* in the County of *Brie*; his Father deſigned to make a Prieſt of him, but he did not feel in himſelf any Call to that Holy Office. However, out of Obedience to his Parents, he ſtudied Divinity three Years, at the end of which, as he continued to decline taking Orders, his Father refuſed to contribute any longer towards his Subſiſtance at *Paris*. 'Tis very common for Men to embrace that kind of Life to preſerve themſelves from want, but he choſe rather to fall into want than to become a Clergy-Man; by the Sequel of his Life, we ſhall find that the extream Averſion he had to that State was only fonnded upon the great ſenſe he had of his being unequal to the Duties of it; *The Cauſe* *that kept him from it, render'd him more worthy of it.*

His evil Fortune became a great Advantage to him; he ſought out for an Aſylum, and found one with the Reverend Father *Malbranche*, who made him his Amanuenſis. From the dark Scholaſtick Philoſophy, he was thus at once tranſplanted to the Spring of a bright and ſhining Philoſophy, in which he ſaw a total change of every thing, and a new World was diſcover'd to him. Under this Great Maſter he learned the Mathematicks, and the moſt ſublime Metaphyſicks, and at the ſame time conceived a very tender Affection for him, which alone is a ſufficient Commendation both of the Maſter and Scholar. Monſieur *Carêe* did ſo well diveſt himſelf of the common Prejudices, and ſo greedily imbibed thoſe new Principles his Maſter taught him, that he ſeemed no longer to ſee with his own Eyes, but by *Reaſon* only, which uſurped in him the Place, and all the Authority of his Senſes. For inſtance, he did not believe that Beaſts were meer Machines in the ſame manner as one may believe it by the ſtrength of reaſoning, and by the Principles of a Syſtem that leads to it; but he believed it as one commonly believes the contrary, becauſe one ſees or fancies that one ſees it; the Artificial Conviction of Philoſophy, tho' ſlowly formed by long windings and turnings was equal in him to the moſt natural Conviction, and ſuch as might have been cauſed by the quickeſt and livelieſt Impreſſions. *What he believed, that he ſaw; whereas others believe, becauſe they ſee.*

However, it is infinitely more eaſie to become the Slave of certain ſpeculative Opinions, very oppoſite in appearance, than to be ſincerely and tranquilly Maſters of our Paſſions. Monſieur *Carrée*, who did not forſake his old Principles by halves, was come thus far, and was ſo much the more obliged to come thither, as the Syſtem which he had embraced with ſo much Zeal, was a perpetual Union of Philoſophy and Chriſtianity. His Metaphyſicks made him deſpiſe the *occaſional Cauſes* of Pleaſures, and united him to their ownly efficacious Cauſe; the love of Order eſtabliſh'd Juſtice in the bottom of his Heart, and render'd all his Duties Pleaſures; in a word, Philoſophy was not in him a light Tincture, nor a ſuperficial Ornament, but became a profound Sentiment, and a ſecond Nature, very hard to be diſtinguiſh'd from the firſt.

After having been ſeven Years in that excellent School, where he learned all that we have mentioned, the neceſſity of looking out for ſome kind of Employment, in order to his Subſiſtance, obliged him to leave it, and to go into the City to teach the Mathematicks, and Philoſophy, and eſpecially that kind of Philoſophy of which he was ſo full: The relation it has to Morality, and to the true Happineſs of Man, made it become infinitely more valuable to him than all the Geometry in the World. He even endeavour'd to proceed in ſuch a manner, as that Geometry ſhould only be a ſtep to guide him to his dear Metaphyſicks, which he had always in view, and his greateſt Pleaſure was continually to procure new Votaries to it. His Zeal and Cares met with all the Succeſs he deſired; he convinced all whom he undertook, unleſs it were ſuch Philoſophers as had been harden'd in other Syſtems.

I know not by what particular Fate it was that he reckon'd a great many Women among his Diſciples. The firſt of thoſe whom he had converted, ſoon diſcover'd that Monſieur *Carrée* was guilty of ſeveral odd and improper ways of Speaking; whereupon ſhe told him, that ſhe would pay his new Philoſophy by teaching him to ſpeak true French, and he acknowledg'd that he had very much improved his Language by her Inſtructions. In general, he had a great Opinion of the Senſe of Women, even with reſpect to Philoſophy, whether it was that he found them more tractable, becauſe they had not been prejudiced by any contrary Notions, and that they only endeavour'd to Learn, and not to Diſpute; or whether he was better pleaſed with their zealous adherence to the Opinions they had embraced; or laſtly, whether it was upon account of that general Inclination we have for that Sex which acted in him, without his perceiving it; and made them appear to him better Philoſophers, that being the greateſt Ornament they could have in his Eyes.

His Converſation with them did yet ſeaſon the Myſtery: *for Women are not leſs obliged to conceal the acquired Lights of the Mind than the natural Sentiments of the Heart; and their greateſt Art ought always to be even ſcrupulouſly to obſerve the external Decencies of Ignorance.* He would therefore never make mention, or tell the Names of thoſe Ladies whom he inſtructed; nay, he would not ſo much as viſit them, but with ſuch

Precautions as are uſed upon a very different Occaſion. Beſides the Women of the World, he counted among his Diſciples ſeveral Nuns, yet more Docil, more Studious, and more eaſily embark'd in that which affects them.

In ſhort, he found himſelf at the head of a little hidden Empire, but which would ſubmit to nothing but *Reaſon*, nor obey any thing but *Demonſtration.*

The Buſineſs of Teaching in the City, is not leſs an Enemy to Studies, than the Diſtractions occaſioned by Pleaſure. It is true, one may ſtrengthen and confirm one ſelf in what one knows already; but 'tis impoſſible to make new Acquiſts, eſpecially if one has the Misfortune to be very much employed.

And accordingly Monſieur *Carrée* wanted very much of being as far advanced in the Mathematicks as he could go; he ſaw with wonder and with grief too, the ſublime and rapid Flights of certain Geometricians of the firſt Order, whilſt the Cares for his Subſiſtance forced him, in ſpight of his Inclinations, to creep upon the Ground. He followed them however as far as he could with his Eyes; he made the beſt uſe he could of his Time, to ſtudy thoroughly what he communicated to the Publick; he enriched himſelf with their Diſcoveries, and if he was concerned that he himſelf could not make as ſhining ones, he did much leſs regret the Glory than the Knowledge which they produced.

Monſieur *Varignon*, who has been always very careful in the choice of thoſe Pupils which he made in the Academy, took him for his, in the Year 1697. Monſ. *Carrée* thought himſelf obliged to convince the Publick that he deſerved the Title of Academiſt, and having therefore ſurmounted his Natural Averſion of appearing in Print, he put out the firſt Body of a Work, that has appeared upon the *Integral Calculation*; the Title of it is, *A Method for the Meaſure of the Surfaces, the Demenſion of Solids, their Centres of Gravity, of Precuſſion, and of Oſcillation. In the Year* 1700. The Preface of this Book declares it to be only for the moſt plain an eaſie Application of the Integral Calculation; it ſets it at a juſt Price, and is neither Boaſting nor Modeſt; but, which is more valuable than Modeſty it ſelf, exactly true. The Author afterwards acknowledges ſome Faults, and had the Glory of correcting 'em in a Second Edition.

The Fate of Monſieur *Varignon*'s Pupils is to make their way readily enough in the Academy, the reaſon of which has been already given. Monſ. *Carrée* became in a little time *Aſſociate*, and at laſt *Penſioner*; an Eſtabliſhment ſufficient to ſuch moderate Deſires as his, and which enabled him to give himſelf up entirely to his Studies. As he had the Office of a Mechaniſt, he turned his chief Thoughts that way, and applied himſelf to every thing belonging to Muſick, ſuch as the Theory of Sounds, the Deſcription of different Inſtruments, *&c.* He did not embrace that Study on the Account of its being the ſpring of one of the greateſt Pleaſures of Senſe, but as it required an Infinity of crabbed and thorny Diſcoveries: Our Hiſtory of the Academy has given ſome Sketches of his Meditations upon this Subject.

His Labours were very much interrupted by a continual Indiſpoſition into which he fell, and which grew upon him during the laſt five or ſix Years of his Life; his Stomach did very ill perform its Functions, and his Phyſicians obſerved from the Nature of his Diſtemper, that very corroſive Acids which were predominant in his Conſtitution did entirely deſtroy it. Being almoſt incapable of Studying, and yet more ſo of any profitable Employment, he found a Retreat with Monſ. *Chauvin*, one of the Counſellors of Parliament, who was no otherwiſe incommoded by his Gueſt, than from the Difficulty he had of making him receive ſuch Aſſiſtance as was neceſſary to him.

After a long Alternative of Relapſes and Intervals of a very weak Health, he fell at laſt into a Condition in which he was the firſt that pronounced Judgment againſt himſelf. He told the Prieſt, who according to the uſual Cuſtom was ſeeking Expedients to prepare him for Death, *That Philoſophy and Religion had long ſince taught him the Art of Dying*. Indeed he met Death with all that Conſtancy that both Philoſophy and Religion are capable of giving. He reckon'd up with great Tranquility how many Days he had yet to live; and when upon the laſt Day, how many Hours; for that *Reaſon*, which he had ſo much cultivated, was revered even by the Diſtemper it ſelf. Two Hours before his Death, he cauſed to be burnt in his preſence ſeveral Letters that he had received from Women. It is eaſie to gueſs at the Subject of thoſe Letters, and that his Diſcretion was very different from that which is ſhewn in the like Caſe by many other People of another make than he was. He died the 11th of *April*, 1711. I ſhall only add a few ſtrokes to what I have already ſaid upon the Character of the Man.

He never asked twice what was his Due for the Pains he had taken. People were free to uſe him as ill as they would in that reſpect; and moreover they were ſure of its being a Secret. He loved the Academy as his ſecond Country, and would have done for its ſake the Exploits of a Roman. It is true, I can give no other Inſtances of it than the Diſcourſes that he and I have had upon certain Occaſions, but thoſe Diſcourſes were ſtrictly ſincere, and proved as much as the Actions of another Man. I knew likewiſe that in one of thoſe Fits in which he thought he ſhould have died, he endeavour'd to put off that Panegyrical Account of him which I am obliged to give of all thoſe Academiſts we have the Misfortune to loſe: His Modeſty muſt have been very great, to fear ſo plain and honeſt a Diſcourſe, and in which ſo little Eloquence is uſed by us. He left the Academy ſeveral Treatiſes compoſed by him upon different Subjects of Phyſicks or Mathematicks, and thereby made her his univerſal Heir.

His Place of *Penſionary Mechaniſt* was filled by Monſieur *de Reaumur*.

The LIFE *of Monſieur* BOURDELIN.

C*Laude Bourdelin* was born the 20th of *June*, 1667. He was the Son of *Claude Bourdelin*, Penſionary Chymiſt of the Academy, of whoſe Life we have given ſome Account in our Hiſtory for the Year 1699. He was brought up with great care in his Father's Houſe: The late Monſ. *du Hamel*, Secretary of the Academy, choſe him all his Maſters, and watched over his Education. At the Age of 16 or 17 Years he had Tranſlated all *Pindar* and *Lycophron*, the moſt difficult of the *Greek* Poets; and on the other hand, he had made himſelf Maſter, without any help, of the great Work of Monſ. *de la Hire* upon the *Conic Sections*, more crabbed, for the *Matter* of 'em, than the above-mentioned Poets are for their *Stile.* 'Tis a great Journey from the *Greek Poets* to the *Conic Sections.*

The Variety of his Learning put it into his Power to chuſe what Employment he would, but his Natural Inclination determined him to Phyſick, in which he had already received great aſſiſtance at home. He was born in the midſt of the whole *Materia Medica*, in the Boſom of Botany and Chymiſtry; He therefore applied himſelf with vigour to the neceſſary Studies, and was received Doctor in Phyſick of the Faculty at *Paris*, in 1692.

In this Profeſſion he loved both the Knowledge it required, for which he had a very happy diſpo-

ſition;

ſition; and yet more beyond Compariſon, the Advantage it would bring to Mankind. This Advantage, which ought always to be the principal Object of the Phyſician, as well as of Phyſick it ſelf, was the ſole aim of Monſ. *Bourdelin.* It is true that he was born to a very good Fortune, and might have lived at his Eaſe, tho' all the World had continued in good Health, but his Diſ-intereſtedneſs did not proceed from his Fortune; it was the reſult of his Character, for it is no ſtrange thing for a rich Man to deſire to be richer. Monſieur *Bourdelin*'s Patients were unprofitable enough to him, excepting the Satisfaction he had in aſſiſting them, for *his Care was to viſit as many of the Poor as he could, and he viſited them preferably to others; he paid for their Medicines, and even provided often for them ſuch other Helps as they ſtood in need of*; and *as for the rich People, he ſtudiouſly avoided to receive from them what was his Due; he was plainly uneaſie when he received his Fees; and without doubt the greateſt part of ſuch Patients readily ſpared his Modeſty, or accommodated themſelves to his Generoſity.*

As ſoon as the Peace of *Ryſwick* was concluded, he laid hold of it to ſee the Learned Men of *England*; the Reward of his Journey was a Place in the *Royal Society*, he did not ſeek for it, and it was therefore ſo much the more his due.

He was not leſs favourably treated in his own Country. The Academy of Sciences, which had a Right to him by many Titles, choſe him for one of their *Aſſociate Anatomiſts*, upon their new Eſtabliſhment in 1699. He was a great Maſter, not ſo much of Anatomy it ſelf, as of its Hiſtory, or of Anatomical Learning. In our Hiſtory for the Year 1700, it may be ſeen, that upon a very difficult Queſtion, which divided the Anatomiſts of the Academy, and in which there was ſome Matters of Fact and Difficulties upon the Choice of the neceſſary Operations, they had recourſe to Monſieur *Bourdelin*, and that he laboured very advantageouſly in the Preliminaries towards the Explanations thereof.

In 1703, he bought the Office of Phyſician in Ordinary to the Dutcheſs of *Burgundy*. We are aſſured that one of his Principal Motives was, the Deſire he had to beſtow upon the Publick his Pains entirely free from Intereſt, and to deliver himſelf from thoſe uneaſie Acknowledgments which he could not altogether avoid in *Paris*. We ſhould not have advanced a Fact ſo very unlikely, if his whole Conduct had not proved the ſame. Before he removed to *Verſailles*, he ſpent four or five Months in refreſhing his Botany with Monſieur *Marchant* his Friend and Collegue. He foreſaw very well that he ſhould not have much time to go a Simpling in his new Habitation: He was reſolved therefore to fortify himſelf before-hand with all the Lights neceſſary to that purpoſe. When he left the Town it was a general Affliction and Mourning among all the Poor in his Neighbourhood. *The greateſt Qualities of Men, are thoſe of which the common People are the beſt Judges.*

He lived at *Verſailles*, as he had done at *Paris*, as diligent without any private Intereſt, as indefatigable, or at leaſt as prodigal of his Pains, as any Phyſician in the World that was in the greateſt need, and had the greateſt deſire of heaping up Riches. His love of the Poor was always his predominant Paſſion. When he returned home from viſiting a great many poor Wretches in their Beds, he always found a Troop waiting for him at his Doors. It is reported, that one day as he paſſed along the Streets in *Verſailles*, ſome of the common People cried after him, *'Tis not our Phyſician, but our Saviour*; an Exaggeration fooliſh in itſelf, but in ſome manner excuſable, becauſe it ſhewed the Gratitude as much as the Ignorance of thoſe poor Creatures.

It is particular enough, that in a Place where all Profeſſions, be they what they will, are turned into that of Courtier, he continued a Phyſician ſtill, and did no more than his Buſineſs at the hazard of not making his Court; but his great Reputation made it for him, for Monſ. *Bourdelot*, firſt Phyſician to the Dutcheſs of *Burgundy*, dying in 1708, that Princeſs, of her own accord, recommended Monſieur *Bourdelin* to the King for ſo conſiderable a Place, and immediately obtained his Conſent. She had the Glory and Satisfaction of rewarding Merit that did not ſeek it; the Courtiers knew of his Advancement before himſelf, and he was only informed of it by the Compliments they paid him.

His Manners were not changed, nor ſhaken by his new Dignity, he was always the ſame, only he was more Bountiful to the Poor, becauſe his Abilities were increaſed. However, his continual Fatigues very much weaken'd his Health. A troubleſome and dangerous Cough ſuffer'd him to take no reſt. Whether it was an Indifference for Life, or whether it was a certain Intemperance, and Exceſs of good Works, a Fault that is not very common, he is charged with not taking ſo much care of himſelf as he always took of others. *He drank Coffee to keep himſelf from ſleeping, that he might work the more, and then took Opium to recover his Sleep.* Above all, it was the immoderate uſe of Coffee that he was the moſt blamed for; he made himſelf believe a long time that he was irrecoverable, to the end that he might drink as much as he would of it. At laſt after having fallen by degrees into a great Extenuation or Leanneſs, he died of a Dropſie in the Stomach the 20th of *April*, 1711. His laſt words were, *In te Domine ſperavi, non Confundar*----He could not finiſh the two Words that remained. *Such a Life as his was Worthy to end with ſuch great Tokens of Faith.*

He left four Children by a moſt virtuous Wife, with whom he always lived in the greateſt Friendſhip and Affection. We ſhall not ſtay to relate how zealous and officious he was for all his Friends, how kind and good to his Domeſticks; it is better to leave you to gueſs at the natural Conſequences of the Character in which we have repreſented him, than to be ſuſpected of Partiality, in loading him with too many Perfections.

His Place of *Aſſociate Botaniſt*, to which he had been preferr'd from that of *Anatomiſt*, was ſupplied by Monſ. *Geoffroy*, the Younger.

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The LIFE of Monſieur BERGER.

CLaudius Berger, the Son of *Claudius Berger*, Doctor of Phyſick of the Faculty of *Paris*, was Born on the 20th of *Jan.* 1679. He had devoted himſelf to his Father's Profeſſion, and whilſt he was a Student of the Faculty he maintained a Theſis, Mr. *Fagon*, the King's firſt Phyſician, preſiding, againſt the Uſe of Tobacco; the Stile and Learning of which were generally admired, but the Precepts very little followed.

Tho' Monſ. *Berger* was related to Monſ. *Fagon*, and pretty nearly too, 'twas upon the occaſion of this Theſis that he came to be more particularly known than he had been before, and was received into a Friendſhip and Patronage, which their Kindred alone could not have obtained for him.

Monſ. *Berger* applied himſelf a great while to the Study of Plants under Monſ. *Tournefort*, in which he made ſuch a Proficiency that this great Botaniſt procured him to be admitted as his *Pupil* into the *Academy* of *Sciences*, upon its Re-eſtabliſhment in the Year 1699. Since when, upon certain Diſpoſitions made in that Society, he became the *Pupil* of Monſ. *Homberg*. He appeared equally fit to fill one day the chiefeſt Places either in Botany or Chymiſtry.

But different Employments diverted him from thoſe Functions that are required by the Academy; having taken his Degree of Doctor of Phyſick, he was obliged to profeſs a Courſe of it in the Schools of *Paris* for the Space of two Years, which he did with great Succeſs. Beſides, his Father who was a good Phyſician, and had a great deal of Practice, took him often with him to his Patients, and inſtructed him in his Buſineſs, both by his own Example, and by the Obſervation of Nature her ſelf, a more efficacious and lively Leſſon than all thoſe that are taken out of Books; and as his Father, by reaſon of his Indiſpoſitions, was confined to his Houſe the two laſt Years of his Life, he diſcharged his Function by the means of his Son, to whom he gave his Preſcriptions as well as his Learning; and accordingly after his Death, which happen'd in 1705, the Son ſucceeded to all that Truſt and Confidence which had been put in his Father, and found himſelf poſſeſſed of all his Patients, as it were by Inheritance. At laſt Monſ. *Fagon*, who was Profeſſor in Chymiſtry to the Royal Gardens, but could no longer follow that Buſineſs, made Monſ. *Berger* his Deputy in the Year 1709; and after he had been ſo the two following Years, Monſ. *Fagon* was perſwaded that he acquitted himſelf ſo well therein, that he obtained of his Majeſty the Survivorſhip for him, a Favour which he would not have eaſily asked for a Perſon that was but indifferently qualified for it, becauſe we know that he had always been very jealous of the Honour of that Place.

All theſe things, tho' they hinder'd Monſ. *Berger* from the punctual Diſcharge of his Duty to the Academy, did nevertheleſs qualify him to become a great Academiſt; and it is very probable the Society would have been the better, even for thoſe his Avocations and Employments that did not immediately concern them; but his tender Conſtitution could not bear up againſt the great Buſineſs he was engaged in, and his Lungs being attacked, he died the 22d of *May*, 1712. Monſieur *de la Carliere*, the Duke of *Berry*'s firſt Phyſician, and very noted in his Profeſſion, had deſigned him for his only Daughter, and all the Circumſtances of that kind of Adoption are ſtill part of Monſ. *Berger*'s Character. His Place of *Pupil* to Monſ. *Homberg* was filled by Monſ. *Imbert*, Doctor of Phyſick.

The LIFE *of Monſieur* CASSINI.

JOhn Dominic Caſſini was born at *Perinaldo* in the County of *Nice*, the 8th of *June* 1625. His Father was *James Caſſini*, an *Italian* Gentleman, and his Mother's Name was *Julia Croveſi*. As ſoon as he was out of his Childhood, he was put under the Care of a very able Tutor, with whom he made his firſt Studies: He continued 'em in the College of Jeſuits at *Genoa*, where ſome of the Latin Poems of this Scholar were printed with thoſe of his Maſters, in a Folio Collection, in the Year 1646.

He contracted a very intimate Friendſhip with Monſ. *Leſcaro*, who was afterwards *Doge* of that Republick. He was with him at one of his Seats when a Clergyman put into his Hands ſome Books about *Judiciary Aſtrology*. His Curioſity was ſtirred up by them, and he made an Extract for his own Uſe; that natural Inſtinct which led him to the

Knowledge of the Stars, made him then miſtake *Aſtrology* for *Aſtronomy*, in the Study of which he advanced ſo far as to make ſome attempts at Predictions, and not without Succeſs; but even that which would have plunged another into perpetual Errors made him ſuſpect it. He diſcover'd by the integrity of his Mind, that this Art of foretelling was merely Chimerical, and he feared, ſuch was the Delicacy of his Conſcience, that Succeſs was the Puniſhment of thoſe that applied themſelves thereto. He carefully peruſed the fine Work of *Pica de la Mirandula* againſt *Aſtrologers*, and then burnt the Extract he made from their Books. But whilſt he was amuſing himſelf with the trifling and ridiculous Study of *Aſtrology*, he diſcover'd the ſolid Charms of *Aſtronomy*, and was ſenſibly affected with them.

Tho' Aſtronomy were not ſo abſolutely neceſſary as it is in Geography, in Navigation, and even in Divine Worſhip, it would be infinitely worthy of the Curioſity of all Humane Minds, on account of that great and lofty Spectacle it preſents to their View. There are in certain very deep Mines ſome miſerable Wretches that both live and die without ever ſeeing the Sun; ſuch is in a manner the Condition of thoſe that are ignorant of the Nature, Order and Motion of thoſe great Globes that roll over their Heads, to whom the greateſt Beauties of Heaven are unknown, and who have not Senſe enough to enjoy the Univerſe. This is the Buſineſs of *Aſtronomers*, they both give us Eyes, and unvail to us the vaſt Magnificence of a World that is inhabited by almoſt none but Blind Men.

Monſ. *Caſſini* applied himſelf zealouſly to Aſtronomy and the Preliminary Sciences, in which he made ſo ſwift a Progreſs, that in 1650, that is to ſay, when he was but 25 Years old, he was choſen by the Senate of *Bologna*, to fill the firſt Chair of Aſtronomy in their Univerſity, which had been vacant ſome Years by the Death of Monſieur *Cavalieri*, the famous Author of the *Geometry of the Indiviſibles*, and forerunner of the *Infinitely Littles*, to whom they had not yet been able to find a worthy Succeſſor. Upon his Arrival at *Bologna*, the Marq. *Cornelio Malvaſia*, who had very much contributed to the inviting him, received him into his Houſe. That Marquis was one of the Senators of his Country, General of the Troops of the Duke of *Modena*, and a learned Man. Three Qualities which he joined together, after the Example of the ancient *Romans*, but ſo uncommon in this Age, as to be accounted almoſt fabulous.

At the end of the Year 1652, a *Comet* came to try the Skill of our new Profeſſor of Aſtronomy, and to offer it ſelf to him as one of the greateſt Difficulties of his Trade. He obſerved it with Mr. *Malvaſia*, who was alſo an Aſtronomer; it paſſed by their *Zenith*, an uncommon Circumſtance. Monſ. *Caſſini* made all the Enquiries upon this Phenomenon that Art could deſire, and all the Determinations he could furniſh, and in 1653, publiſhed a Treatiſe upon it, which he Dedicated to the Duke of *Modena*.

In that Work he takes *Comets* to be nothing but fortuitous Generations, and a maſs of Exhalations proceeding from the Earth and from the Stars too; but he ſoon formed a more particular and noble

Idea of them; He perceived that the Motion of his Comet might be unequal in appearance only, and that it was reducible to as great an Equality as that of a Planet; and from thence he conjectured that all the Comets, which had always paſſed for new Stars, and were thought to be entirely exempt from the Laws of all the reſt, might be both of the ſame Regularity and of the ſame Antiquity too as thoſe Planets to which we have been accuſtomed from the beginning of the World. *In all matters, the firſt Syſtems are too ſhort, too narrow, and too diffident, and it ſeems as if Truth it ſelf were only to be the Prize of a certain Boldneſs of Reaſon.*

It was this happy and wiſe Boldneſs which made him undertake the Reſolution of a Problem which was fundamental for all Aſtronomy, which had been attempted ſeveral times by the moſt able Mathematicians, but without Succeſs, and even declared impoſſible by the famous *Kepler*, and by Monſ. *Bouillaud*, a great French Aſtronomer, *viz. Two Intervals between the true Place, and the middle Place of a Planet being given; it was required to determine Geometrically the Apogæum and Excentricity thereof?* Monſ. *Caſſini* performed it, and very much ſurprized the learned World. His Problem began to open to him a Way to a new and more exact Aſtronomy; but as he ſtood in need of a great number of Obſervations to render his own Invention uſeful, and which he had not yet the time to make (having hardly attained to the Age of 26 Years) he writ to Monſ. *Gaſſendi* in *France*, deſiring him to communicate thoſe that he might have made, chiefly upon the

Superiour Planets; he obtained them without difficulty from a Man that was both zealous for the Sciences, and favourable to the Reputation of thoſe that cultivated them.

But there remained yet at the bottom of Aſtronomy ſeveral important Doubts and eſſential Difficulties. It is certain both that the Sun appears to move more ſlowly in Summer than in Winter, and likewiſe that it is more remote from the Earth in Summer; this greater Diſtance ought to leſſen the appearance of its Swiftneſs; but is there not moreover a real diminution in that Swiftneſs?

It is the Sentiment of *Kepler* and *Bouillaud*; all the reſt, both Ancient and Modern, believe the contrary; and the Certainty of the Theory of the Sun and of the other Planets depended in a great meaſure upon this Queſtion; to decide which, it was neceſſary to obſerve whether when the Sun was moſt remote from the Earth, the diminution of its Diameter, for it ought then to appear leſſer, did exactly follow the ſame Proportion as the diminution of its Swiftneſs; in this Caſe moſt certainly all the diminution of Swiftneſs was only apparent, but the difficulty was to make thoſe Obſervations with ſufficient Certainty; but as the Queſtion was only about a Minute, more or leſs, in the greatneſs of the Sun's Diameter, and the Inſtruments were too ſmall to give it with Certainty, every Obſerver might either add or take it away at his pleaſure, and diſpoſe of it in favour of his Hypotheſis, and ſo the Queſtion would always remain undetermined. We ſhall give no more than this inſtance of the extream Importance that even the ſmalleſt Quantities may be with reſpect to Aſtronomy; tho' in all other Caſes they are hardly worth notice. In general, it is eaſie to conceive that when we make uſe of a Quadrant for Obſervations, the proportion it bears to the Greatneſs, which it is to meaſure, is almoſt infinitely little, ſince the thickneſs of a Silken Thread anſwers two Millions of Leagues in the Heavens; thus the nicety and exactneſs of Aſtronomy requires large Inſtruments.

An Occaſion happily offer'd it ſelf to Monſieur *Caſſini* to procure the largeſt that ever was made, juſt at the time when he was upon new modelling this Science. The Confuſion into which the *Julian Calender* was fallen, by the neglect of ſome Minutes yearly, awaken'd the Aſtronomers of the 16*th* Century; they would find by Obſervation the *Equinoxes* and *Solſtices*, which the Calender did not give within ten Days at leaſt of the true time; and for that purpoſe *Egnazio Dante*, a Dominican Fryer, and Profeſſor of Aſtronomy at *Bologna*, in the Year 1575, drew in the Church of *St. Petronia*, a Line, which ſhew'd the Sun's way during the whole Year, and chiefly its arrival at the *Solſtices*. In the Year 1653, that Church was enlarged, which put Monſ. *Caſſini* upon a deſign of drawing, in another Part of the Church, a Line that ſhould be longer and more exact and uſeful than that of *Dante*, which was not even a *Meridian*. As it was neceſſary that the Line ſhould be perfectly ſtreight, and that by its Poſition it was obliged to paſs between two Pillars, it was thought at firſt it could not paſs, and muſt be loſt againſt one or the other.

The Magiſtrates, who had the Care of Building, ſcrupled giving their Conſent to ſo doubtful a Project. Monſ. *Caſſini*, by a Treatiſe which he publiſhed, convinced them that it was practicable. He had taken his Meaſures ſo nicely, that the *Meridian* paſſed by the Sides of thoſe two dangerous Pillars, that had like to have made his whole Deſign miſcarry.

A round Hole horizontal, an Inch in diameter, bored through the Ceiling, and of a perpendicular Heighth of a thouſand Inches over a Marble Pavement, upon which the Meridan was traced, receives every Day, and ſends to the South upon that Line, the Image of the Sun, which there becomes Oval, and moves upon it from Day to Day, according as the Sun approaches or recedes from the Zenith of *Bologna.* When the Sun is as near it as it can be, one Minute of variation in its Heighth, is anſwer'd by four Lines of a Foot (*Paris* meaſure) upon the Meridian, and when the Sun is fartheſt off, two Inches and one Line; ſo that this Inſtrument is of an Exactneſs beyond what could have been expected; it was made with a Care and Application that was almoſt ſuperſtitious. Father *Riccioli*, a good Judge of theſe Matters, ſays, it was more Angelical than Humane; the Particularities of it would be infinite. *In the Mathematical Sciences, Practice is a Slave, and Theory its Queen*, but here the Queen is abſolutely depending upon the Slave.

This great Work being finiſhed, or at leaſt ſufficiently advanced, Monſ. *Caſſini* publickly exhorted all the Mathematicians to obſerve the Summer *Solſtice* of the Year 1655. He ſaid, in that Poetical Stile, which the dry Study of the Mathematicks had not deprived him of, that he had ſet up an Oracle of Apollo of the Sun in a Temple, which might be confidently conſulted upon all the Difficulties of Aſtronomy. One of the firſt Anſwers this Oracle render'd was, upon the Variation of the Sun's Swiftneſs; he declared poſitively in favour of *Kepler* and *Bouillaud*, that it was partly real; and thoſe whom he condemned ſubmitted themſelves. Monſ. *Caſſini* printed that ſame Year a Treatiſe upon the Uſe of his Meridian, and Dedicated it to Queen *Chriſtina* of *Sweden*, who was lately arrived in *Italy*, and upon the account of her Taſt for the Sciences was worthy ſuch an Entertainment.

The New Obſervations of Monſ. *Caſſini* were ſo exact and deciſive, that from them he compoſed Tables of the Sun, more certain than thoſe that had been hitherto publiſhed. It might have been objected againſt him, that his Meridian was a great help, which other Aſtronomers wanted; but then that aſſiſtance was wholly owing to himſelf.

Nevertheleſs his Tables had ſtill one defect which his Oracle did not fail to take notice of. *Tycho Brahe* firſt diſcovered that the *Refractions* increaſed the apparent Heighth of the Stars above the Horizon, but his Opinion was, that thoſe *Refractions* did not extend farther than to the 45*th* Degree, after which they entirely ceaſed. Monſ. *Caſſini* followed the ſame, but after many Trials and Geometrical Examinations of the Nature of *Refraction*, which till then had not been known, but by Obſervations always liable to ſome miſtake, he found that they reached even up to the *Zenith*, tho' from the 45*th* Degree quite to the *Zenith* there was but one Minute to be divided among the 45 Degrees that remained; another ſeeming Trifle in Aſtronomy, but of the utmoſt Conſequence. It is the Fate of Novelties (of thoſe even that are the beſt proved) to be contradicted. Among thoſe that oppoſe them, we count for nothing a Drawer of Horoſcopes, who writ againſt his Syſtem of Refractions, and objected that he was not yet old enough to know them. Father *Riccioli* himſelf did at firſt ſcruple to ſubmit to it, but Monſ. *Caſſini* cited him before St. *Petronia*, where he was very ſtrong.

He made uſe of his new Theory of Refractions to compoſe ſecond Tables more exact than the former; he joyned thereto the Parallax of the Sun, which he believed, tho' with ſome doubting as yet, could not be above ten Seconds, and thereby he removed the Sun from the Earth ſix times farther than *Kepler* had done, and eighteen times more than ſome others. The Marq. *Malvaſia* calculated *Ephimerides* for five Years, beginning at 1661. Monſ. *Gemignano Montanari*, Profeſſor of the Mathematicks at *Bologna*, declared in Print, that when they computed by thoſe Ephimerides, the Inſtant in which the Sun ſhould arrive at a determinate Point of the Meridian of St. *Petronia*, it never failed to happen accordingly. *Lansberg* has been formerly convinced of falſifying his Obſervations to make them agree with his Tables; ſo much did the Aſtronomers flatter themſelves with attaining to that Agreement, and the reſt of Mankind, with enjoying the Opinion of others, even where there was no foundation for it.

But Monſieur *Caſſini* was interrupted in his Aſtronomical Employments, and forced to come down from the Region of the Stars, to apply himſelf to Affairs that were meerly Terreſtrial; the frequent Inundations of the River *Po*, its uncertain and irregular

Courſe, the Diviſion of its Branches ſubject to changing, even the Remedies themſelves applied to this Evil (which ſometimes did nothing but increaſe, or remove it from one Country to another) all this I ſay, had been an old and fruitful Spring of Differences between the little Governments bordering upon the ſaid River, and chiefly between *Bologna* and *Ferrara*. Thoſe two Cities, tho' both ſubject to the Pope, are diſtinct Governments, and both of 'em have preſerved the Rights of ſending Ambaſſadors to their Sovereign. As the People of *Bologna* had a great many things to regulate with thoſe of *Ferrara*, upon the occaſion of the Waters, they ſent the Marquis *Tanara* Ambaſſador Extraordinary to Pope *Alexander* VII. in the Year 1657, and order'd Monſ. *Caſſini* to accompany him in an Affair in which the Mathematicks had ſo great a part, perhaps too they were glad of that occaſion to ſhew the *Romans* the Acquiſition they had made of ſo learned a Man.

Being at *Rome* he publiſhed ſeveral Diſcourſes upon the Buſineſs that carried him thither; he went into the Detail of the whole Hiſtory of the *Po*, which he extracted both from Ancient and Modern Books, and from all the Monuments that remained thereof; for his profound Study of the Mathematicks had not excluded that of other kinds of Learning. He made, in the Preſence of the Committee of Cardinals appointed for the Waters, a great many Experiments relating to that matter, and which ſerved to ſupport the Pretenſions of thoſe who had deputed him; and he made appear the ſame Care and the ſame Exactneſs, that he was thought only capable of, in reſpect to the Heavens;

accordingly the Senate of *Bologna* were of Opinion, that they could not ſufficiently reward his Services, but by conferring upon him the Office of Superintendant of the Publick Waters, an Employment of which we have before given an account in the Life of Monſ. *Guglielmini.* They joyned him in Buſineſs with ſeveral Cardinals, to ſhew, that tho' he was a great Mathematician, he was as well qualified for worldly Affairs as other Men.

In the Year 1663, *Don Mario Chigi*, Brother to *Alexander* the VII. and General of the Holy Church, gave him the Direction of the Fortifications of *Fort Urbano*, of which he never dreamt: He found himſelf then transferred at once to the Military Services, and applied himſelf to repair the old Works of that Place, and to make new ones; but in the midſt of thoſe Occupations, he always beſtowed ſome Contemplations upon the Stars.

Mention has been already made in the Life of Monſ. *Viviani*, of the Diſpute that happened between the abovementioned Pope and the Great Duke of *Tuſcany* about the Waters of *Chiana*, and of the ſhare Monſ. *Caſſini* had in that Buſineſs. The Pope, who had demanded him of the Senate of *Bologna* for that purpoſe, order'd the Cardinal *Roſpiglioſi*, afterwards *Clement* IX. to acquaint them that he had conceived a particular Eſteem for Monſ. *Caſſini*, and intended to take him into his Service, without prejudice to his Eſtabliſhment at *Bologna*; and indeed that Pope called him often to him to hear him Diſcourſe upon the Sciences, and promiſed him great Preferments if he would take upon him the Eccleſiaſtical Function, for which he looked upon him to be very well qualified, by the integrity and purity of his Manners. The Temptation was ſtrong, for in *Italy* a learned Clergyman may riſe to ſuch a Rank as hardly to give place to Kings themſelves; there is no other Condition in that Country capable of ſuch great Rewards; but Monſ. *Caſſini* did not find himſelf called to it, and *the ſame Piety which rendered him worthy of coming into the Church, kept him out of it.*

At the end of the Year 1664, there appeared a *Comet*, which he obſerved at *Rome* in the Palace of *Chigi*, in the Preſence of the Queen of *Sweden*, who her ſelf likewiſe made Obſervations, and ſacrificed her Nights to that Curioſity. He depended ſo much upon his Syſtem of the Comets, that after the two firſt Obſervations, which were the Night between the 17th and 18th of *December*, and the following, he boldly marked out for the Queen upon the Celeſtial Globe, that Courſe which the ſaid Comet was to take; when he had made his fourth Obſervation, which was upon the 22*d*, he affirmed, that it was not yet in its greateſt Proximity to the Earth; upon the 23*d*, he foretold that it would arrive there the 29*th*, and tho' at that time it ſurpaſſed the Moon in Swifneſs, and ſeemed as if it would have made the Tour of the Heavens in a little time, he had the Courage to aſſert that it would ſtop in *Aries*, from which it was not above two *Signs* diſtant, and that after it had been there *Stationary*, its Motion would then become *Retrograde*, in reſpect to the Direction it had had before; theſe Predictions met with a great many incredulous Perſons, who maintained that the Comet would diſappoint the Aſtronomer, and who wiſhed it alſo even to the end; after which, when they found that it had perfectly ſubmitted it ſelf to his Laws, they, like the Comet it ſelf, moved backwards, and ſaid there was nothing more eaſie than what Monſieur *Caſſini* had done.

There appeared a Second in the Month of *April* 1665; he preſently made a Calculation or Table for it, which confirmed what he had done upon the preceding Comet; ſome of thoſe who did not believe him, ſet themſelves to imitate him, but unfortunately; they would likewiſe form Syſtems, and pretended that the new Comet was the ſame with the other, but the very Obſervations refuted them. As for him, about 8 or 10 Days after the firſt Appearance, he publiſhed his Table, in which the Comet was Calculated with the ſame Exactneſs as if it had been an old Planet; he likewiſe publiſhed at *Rome* the ſame Year, a Latin Treatiſe upon *the Theory of theſe two Comets*, and Dedicated it to the Queen of *Sweden*, and ſome Italian Letters, which he inſcribed to the Abbot *Ottavio Falconieri*, in which he entirely diſcovered his Secret; an Abridgment of which may be ſeen in the Hiſtory of the Academy for the Years 1706, and 1708.

The Queen of *Sweden* having received from *France* an Ephimerides of the Motion of the firſt Comet made by Monſ. *Auzout*, a moſt profound Mathematician and nice Obſerver, and having communicated it to Monſ. *Caſſini*, he diſcover'd therein, thro' ſome affected Diſguiſements, the very ſame Hypotheſis that he had made uſe of with ſo great Succeſs. He writ to the Queen, and the aforeſaid Abbot about it, with a Satisfaction which one might eaſily perceive was ſincere, and which chiefly conſiſted in obſerving that the Truth of his Syſtem was eſtabliſhed by ſuch a Conformity, nor was he at all troubled that another Man ſhared in the Glory of it. This Syſtem induced him to believe that the ſame Comets might appear again after a certain time; and we have likewiſe reported after him, in the Hiſtories of 1699, 1702, and 1706, all the Arguments that might ſupport that Notion, which has aggrandized the Univerſe and augmented its Pomp.

He was about this part of Aſtronomy (ſo new and ſo little handled) when the Pope ſent him back to *Tuſcany*, to treat along with the Miniſters of the Great Duke upon the Buſineſs of the *Chiana*, and at the ſame time beſtowed upon him the Superintendance of the Waters of the Eccleſiaſtical State; when he had diſcharged himſelf of thoſe Commiſſions, he rerurned to his Pleaſures, that is, to his Obſervations of the Heavens.

It was at *Città della Pieve* in *Tuſcany*, the ſame Year 1665, (ſufficiently memorable for Learned Events) that he diſcovered plainly, upon the *Disk* of *Jupiter*, the Shades which its *Satellites* caſt upon it, as they paſſed between *Jupiter* and the *Sun*. His Buſineſs was to diſtinguiſh thoſe Shades from the Spots of that Planet, ſome of which were fixed and others moveable; but thoſe that were fixed, were only ſo for a time; and he did diſtinguiſh them ſo well, that it was by a fixed Spot well aſcertained, that he found out that *Jupiter* turned round upon its Axis in the ſpace of 9 Hours and 56 Minutes. The Learned diſputed with him the Diſtinction between the *Shades* and the *Spots*, tho' he had demonſtrated it Geometritrically, and had foretold both the Times of the going in or coming out of the Shades upon the apparent Disk of Jupiter, and thoſe where the fixed Spot was to appear therein by the Revolution of the Globe. But it muſt be owned, that the extream ſubtilty of theſe Enquiries, and the very nice, and till then the new Uſe that was to be made of *Aſtronomy*, and of *Opticks* together, might be allowed to meet with Oppoſition from the Learned eſpecially, who will not ſubmit ſo readily as others to be inſtructed. *The Suſpenſion of our Belief does honour to the fineſt Diſcoveries.*

Thoſe of Monſieur *Caſſini* were by ſo much the more important, that of all the Planets, 'tis Jupiter at preſent in whom we are moſt concerned. It is he that can decide the Queſtion of the Mobility, or Immobility of the Earth; he ſhews to the Eye, and even more apparently than can be proved with us, all that *Copernicus* did only conjecture about the Earth, and that too with a kind of Raſhneſs.

If we are ſurprized that ſo great a Body as that of the *Earth* ſhould turn upon its own Axis, *Jupiter*, a thouſand times bigger, moves two times and a half more ſwiftly; and if we think it ſtrange that the *Moon* alone ſhould have the *Earth* for the Centre of its Motion, *four Moons* or *Satellites* have *Jupiter* for the Centre of theirs.

When they could no longer deny the Truth of Monſ. *Caſſini*'s Diſcoveries, they endeavoured to rob him of the Honour of them. In the Month of *Feb.* 1667, he laid hold upon a favourable Opportunity of obſerving *Mars* in his approaches to the Earth, and he judged by the Motion of ſome of its Spots, that that Planet turned upon its Axis in the ſpace of

24Hours and ſome Minutes. Thoſe that obſerved it at *Rome*, to whom he had writ concerning it, had a mind to have prevented him, but he aſſerted his own Right very well, and proved that their Obſervations were both poſteriour to his, and not ſo exact: He fixed the Revolution of *Mars* to 24 Hours 40 Minutes; a new Glory for *Copernicus*, whoſe Syſtem was corrobarated in proportion as the Heavens diſcloſed themſelves to the Eyes of Monſ. *Caſſini*. In the ſame Year he likewiſe diſcovered ſome *Spots* upon the Disk of *Venus*, and was of Opinion, that its Revolution might be pretty near equal to that of *Mars*; but as *Venus*, whoſe Orb is between the Sun and us, is liable to the ſame Variations of *Phaſes* as the *Moon*, and that by that Means the returns of its Spots are very hard to be diſcovered with certainty, he determined nothing poſitively, and his Caution upon doubtful Diſcoveries was a Confirmation of the Certainty of the reſt.

In ſpight of the regard that ought to be paid to his uſeful Application to the Obſervations of the Heavens, the neceſſity of having Recourſe to him did too often divert him from thoſe Studies. Beſides the Employments that he had already, and which were foreign to the Buſineſs of Aſtronomy, they put upon him the Inſpection of the Fortifications of *Perugia*, and Repair of the Bridge called *Felix*, which the *Tiber* threatned to quit; he order'd a Work that prevented this Diſorder. As he was poſſeſſed of a general Love for the Sciences, he would likewiſe abandon himſelf ſometimes to voluntary Diverſions.

When he treated with Monſ. *Viviani* upon the Affair of the *Chiana*, he had made ſeveral Phyſical Obſervations upon *Inſects*, which Monſ. *Montalbani*, to whom he communicated them, cauſed to be publiſhed in the Works of *Aldrovandus*. Finally, the Experiments about the Transfuſion of the Blood made in *England* and *France*, and which concerned none but the Phyſicians and Anatomiſts, being become very famous, he had the Curioſity to repeat them himſelf at *Bologna*; ſo eagerly did his Paſſion for Knowledge hurry him on to different Objects; for the ſame Reaſon, as he paſſed thorow *Florence*, in his Journies from *Bologna*, to *Rome*, the Great Duke and Prince *Leopold* cauſed Aſſemblies of their Academy *Del Cimento* to be held in his Preſence, in the Opinion that he would communicate ſome of his Lights to them.

In the Year 1668, he publiſhed the Ephimerides of the Stars of the *Medicis*, for in *Italy* they are very jealous to retain that Name for the *Satellites* of *Jupiter*. *Galileo*, their firſt Diſcoverer, had in vain attempted to Calculate their Motions, and the Eclipſes which they cauſed in *Jupiter*, by depriving him of the Sun, or which they themſelves undergo by falling into his Shade; in effect it looks like an exceſſive and condemnable Boldneſs for Humane Minds to aſpire to ſuch Knowledges. All the Planets move in different Planes, which paſs by the Centre of the Sun; that in which the Earth moves is the *Ecliptick*, the Orbit of *Jupiter* is another Plane inclined to the *Ecliptick* from a certain Number of Degrees, and cutting it in two oppoſite Points. This Inclination of the Orbit of *Jupiter* to the *Ecliptick*, and their common Interſections, tho' enquired into by the Aſtronomers of all Ages, and after a long ſequel of Obſervations, are ſo hard to be determined, that different Aſtronomers diſagree very much with one another about them, and ſometimes even one and the ſame Aſtronomer cannot agree with himſelf. The reaſon is, becauſe theſe Planes, tho' real, are inviſible, and cannot be perceived but by the Mind, nor diſtinguiſhed but by a great Number of very nice Argumentations. What ſhall we then think of Planes that are much more inviſible, if one may ſo ſpeak, in which the Satellites of *Jupiter* do move? It has been neceſſary to diſcover what Angles their Orbits make with that of *Jupiter*, and between themſelves and with our *Ecliptick*, and beſides what is the different greatneſs of thoſe Angles as they are ſeen, or of the Sun, or of the Earth. In a word, in the Tables of theſe new Stars there enter 25 Elements, that is to ſay, 25 fundamental Knowledges or Determinations. It is not only therefore a great Effort of the Mind, to gather together and range ſo many Materials neceſſary to a Building, but likewiſe it is as great a one to know how many of thoſe Materials are neceſſary, and not to forget any one of them.

As ſoon as Monſ. *Caſſini*'s Tables appeared, all the Aſtronomers of *Europe*, who were warned by them of the Time of the Eclipſes of the *Satellites*, obſerved them carefully; among the reſt, Monſieur *Picard*, one of the Members of the new-born Academy of Sciences, and he found pretty often that they anſwer'd to the Heavens with greater exactneſs than the Author himſelf had promiſed; who reſerved to himſelf a Power of rectifying them hereafter. *He had done that for four Foreign Moons*

Moons vaſtly remote from us, and very lately known to us, which all the Aſtronomers of 24 Centuries had with much difficulty done for one Moon.

Monſ. *Colbert*, who by the King's Directions had formed the Academy of Sciences in 1666, deſired that Monſ. *Caſſini* might correſpond with them; but the Paſſion that Miniſter had for the Glory of his Country, would not ſuffer him to be contented with a bare Correſpondence, but induced him to invite him by Count *Graziani*, Secretary of State to the Duke of *Modena*, to come into *France*, where he ſhould receive a Penſion from the King equal to the Employments he had in *Italy*. He made anſwer, That he could not diſpoſe of himſelf, nor accept of the Honour his Majeſty was pleaſed to do him without the Approbation of the Pope, who was then *Clement* the IXth. Whereupon the King deſired the Loan of him from his Holineſs, and from the Senate of *Bologna* by the Abbot of *Bourlemont*, then Auditor of the *Rota*, only for ſome Years; they were afraid they could not obtain him without that Limitation, which probably was added for that purpoſe. They did him the Honour to believe that Artifice neceſſary, and condeſcended to make uſe of it.

He arrived at *Paris* in the Year 1669, being called from *Italy* by the King, as *Soſigenes* another famous Aſtronomer was invited from *Egypt* to *Rome* by *Julius Cæſar*. The King received him both as an uncommon Man, and as a Stranger that abandoned his Country for his ſake. His Intentions were not to ſtay in *France*; and accordingly, at the end of ſome Years, both the Pope and the

Government of *Bologna*, who had continued his Salaries to him, earneſtly deſired him back again; but Monſ. *Colbert* did no leſs warmly diſpute the matter with them, and had at laſt the Pleaſure of conquering, and in the Year 1673, procured him to be Naturalized in *France.* The ſame Year he married *Geneveva* the Daughter of Monſ. *Delaitre*, a Lieutenant-General. The King when he approved of his Marriage, had the Goodneſs to tell him, that he was glad to ſee him become a *Frenchman* for ever. Thus *France* extended her Conqueſts even into the Empire of Learning.

Monſieur *Caſſini* having been a Foreigner, had reaſon equally to fear the partiality of the Publick, either in his Favour or to his Prejudice, and without a great Sock of Merit, he could not have ſaved himſelf from the Danger of either. He was ſenſible that he was going to begin a new Career, which was ſo much the more difficult, as that for the ſupport of his Reputation he was obliged to ſurpaſs it. We ſhall not give the Detail of all that he did in *France*, but only hint at ſome of the moſt remarkable Paſſages.

The Academy having in the Year 1672, ſent ſome Perſons to make Obſervations in the Iſland of *Cayënne* near the *Equator*, becauſe a Climate ſo different from ours was likely to furniſh a number of Obſervations very different from thoſe which are made here, and which might therefore be of great uſe to us, they confirmed all that Monſieur *Caſſini* had laid down ſeveral Years before by Arguments and Theory about the *Parallax* of the *Sun*, and the *Refractions*; ſo nice an Aſtronomer is almoſt a Prophet, and may pretend to the Glory of Aſtrological Predictions.

Moreover, one of the principal Deſigns of that Voyage to *Cayënne* was to obſerve the *Parallax* of *Mars*, at that time very near the Earth, whilſt Monſ. *Caſſini*, and the reſt of the Aſtronomers of the Academy obſerved it here. This Method of knowing the Parallaxes by Obſervations made at the ſame time in very diſtant places is ancient; but Monſ. *Caſſini* found out another, whereby one only Obſerver was ſufficient, becauſe that one fixed Star anſwers to a ſecond. Mr. *Whiſton*, a famous Engliſh Aſtronomer ſays, that this Notion has ſomething of Miraculous in it.

Theſe two Methods concurred in giving the ſame Parallax to *Mars*, from whence that of the Sun followed; after a long Uncertainty it was determined at ten Seconds; and conſequently there is no longer room to doubt that the Diſtance of the Sun from the Earth is at leaſt 33 Millions of Leagues, which is much farther than has been hitherto believed. All the Diſtances of the other Planets are augmented in proportion, and the Bounds of our *Vortex* removed very much backwards.

In the Month of *December* 1680, there appeared a Comet which has been famous. Monſieur *Caſſini* after the firſt Obſervation, told the King, in the Preſence of all the Court, that it would follow the ſame Courſe as that other Planet obſerved by *Tycho Brabé* in 1577. He was in a manner deſtined to make theſe kinds of Predictions to crowned Heads. What made him ſo poſitive upon one only Obſervation was, that he had found that moſt part of the Comets, whether of thoſe that he had ſeen, or that had been obſerved

ſerved by other Aſtronomers, took a particular Road in the Heavens, which for that Reaſon he called the *Zodiac* of the *Comets*; and as that of 1680, appeared in that Zodiac like the Comet of 1577. He was of Opinion that this would follow that, and ſo it did.

In 1683, he perceived for the firſt time a Light in the Zodiac, which perhaps had been already obſerved, tho' but very rarely; but as it had only been taken for a Tranſient Phenomenon, it was not much regarded. As for his part, he preſently conjectured by the Circumſtances of this new Light, that it might be of a durable Nature; he formed a Theory of it, which taught him the Times when it might appear again, being freed and diſentangled from Crepuſcules or Twilights with which it is often confounded; and he found afterwards, that it might be returned to our Eyes by a matter which the Sun ſhould protrude out of it ſelf, much beyond the Orbit of *Venus*, in which it would be involved 'till that Diſtance. As this Light is not always viſible at thoſe times when it ſhould be ſo, it ſeems as if that Derivation of Matter were unequal and irregular, like the Production of the Spots of the Sun. This Phenomenon was ſince obſerved in divers places, and even in the *Eaſt-Indies*: And if Monſ. *Caſſini* be not the firſt Man that ſaw it, at leaſt is he the firſt who has taught others to view it, and procured to it that Attention which it deſerved; nay more, he judged from the Beginning, that if this Light could be ſeen in the preſence of the Sun, it would make it, what is call'd the Hairy Comet; this was a Conſequence of his Syſtem; but perhaps, he himſelf

ſelf ſcarce ever expected to ſee it verified. In 1706, when there was an Eclipſe of the Sun, Men ſaw in thoſe places where it was total, a luminous Hairineſs about that Planet, exactly ſuch a one as Monſ. *Caſſini* had foretold, and which, if it were not the very ſame that he had foretold, was not to be accounted for at all.

In 1684, he compleated the World of *Saturn*, which had remained very imperfect. Monſ. *Huygens*, in the Year 1655, diſcover'd one *Satellite* or *Moon* about that Planet, which was the only one a long time, but has been ſince found to be but the *fourth*, reckoning them from *Saturn*. In 1671, Monſ. *Caſſini* diſcover'd the *third* and the *fifth*, and was fully ſatisfied about them in 1673. Finally, in 1684, he diſcover'd the *firſt* and the *ſecond*; ſince which there has been no more found. Theſe Diſcoveries require a great Niceneſs in Obſervation, and the utmoſt Exactneſs, witneſs the Error into which Father *Rhita* fell, a learned Man otherwiſe, who took ſome little fixed Stars for new *Satellites* of *Jupiter*, and thereupon made his Court to Pope *Urban* the VIIIth, by naming them *Aſtra Urbanoctaviana*, an odd Name, and which would not at all have been proper, even tho' his *Satellites* had been real. Thoſe of *Saturn* have been thought worthy of a Medal in the Hiſtory of the King, with this Inſcription; *Saturni Satellites primum cogniti*.

Here follows another Event of a more ſingular Kind than all the reſt. Monſ. *de la Loubere*, the King's Ambaſſador at *Siam*, in 1687, having ſtudied that Country as a Philoſopher and Learned Man, as far as his ſhort Reſidence there would permit, brought from thence a Method, which was there uſed in Calculating the Motions of the Sun and Moon. It is not performed by Tables after our manner, but by the ſimple Additions or Subtractions, Multiplications or Diviſions of certain Numbers, of which one ſcarce ever ſees any Relation to the Heavenly Motions, and whereof the barbarous and unknown Terms do ſtill increaſe the Strangeneſs of the Calculation. Every thing therein is Confuſion and Obſcurity, which ſeems to be affected, and perhaps may really be ſo; for *Myſtery is the Portion of Barbarity.* Monſ. *de la Loubere* ſent this frightful *Ænigma* to be ſolved by Monſ. *Caſſini*, and according to the Condition and State of Sciences at preſent in the Eaſt, there is all the reaſon in the World to believe, that altho' theſe Rules may be purſued there, it would have been very difficult to have found any one among them that could underſtand them. Nevertheleſs, Monſ. *Caſſini* penetrated into thoſe Darkneſſes; and diſcover'd therein two different *Epocha*'s, which they had not at all diſtinguiſhed; the one a Civil *Epocha*, which fell out in the Year 544, before the Birth of *Jeſus Chriſt*; the other an Aſtronomical, for the Year 638, after the ſaid Birth. He obſerved very happily that *Pythagoras* was alive in the time of the firſt *Epocha*, he whoſe Opinions the *Indians* follow even to this Day, or perhaps who followed thoſe of the *Indians*. Theſe two *Epocha's* being found, were the Key of all the reſt, but ſuch a Key as could not be managed without great Skill. It appears by the unravelling of this Method, that thoſe

Authors were pretty well acquainted with the Motions of the Sun and the Moon, and they could not be ſuſpected to have borrowed ſo different a manner of Calculating from the Weſtern Nations. *Monſ.* Caſſini *muſt have been very familiar with the Heavens to find them out in ſuch a Diſguiſe.*

His Enquiry into this *Indian Calendar* led him to new Reflections upon our own; with a Mind full of heavenly Motions, of Combinations and of all the Periods or Cycles that have been found out, he invented one which he called *Luni-ſolar* and *Paſchal*, becauſe its Effect, according to the Deſign of all the Eccleſiaſtical Calendars, was to make the Motions of the Sun and Moon conformable, with reſpect to the Feaſt of *Eaſter*. This brings back the New Moons to the ſame Day of the *Gregorian* Year, to the ſame Day of the Week, and almoſt to the ſame Hour of the Day for the ſame Place, which is the utmoſt exactneſs in the matter of *Calendars*.

Moreover, it is very Happy and even Sacred, foraſmuch as it has for its *Epocha* the Year of the Birth of *Jeſus Chriſt*; and as Monſ. *Caſſini* by Calculating found in that Year a Conjunction of the Sun with the Moon upon the ſame Day with the *Equinox*, which was the 24th of *March*, the Eve of the Incarnation, according to the ancient Tradition of the Church; this *Epocha* was at the ſame Time *Aſtronomical*, by its falling in with the Equinox and the New Moon, and *Civil* too, by the greateſt Event that ever happen'd upon the Earth. This Period is of 11600 Years, and all the others that have been invented rolled therein. The

World has not ſeen as yet any more than about the laſt Third of one of theſe Periods, which ended upon the Day of the Incarnation; and a little more than the 7th part of another Beginning.

Monſ. *Caſſini* in the Year 1693, publiſhed new Tables of the *Satellites* of *Jupiter*, more exact than thoſe of 1668, and brought to their utmoſt Perfection. He added to it a very inſtructive Diſcourſe upon the fine Aſtronomy of *Jupiter*, of which he kept nothing back. He render'd it both eaſy to every Body, whereas it was only ſo to the Aſtronomers before, and ſo nice, that moſt times the Obſervations agreed with his Calculation, even within the Minute. And accordingly theſe Tables that were calculated for the Meridian of *Paris*, had the Honour to be taken for a perpetual Standard eſtabliſhed at *Paris*, which would give its immediate Obſervations, and by comparing them with thoſe that were made in other Places, a great number of Longitudes were diſcover'd. We find that the Knowledge of this World of *Jupiter*, which is 165 Millions of Leagues remote from us, has produced that of the Earth, and has almoſt changed the Face of it. *Siam*, for inſtance, is now found to be 500 Leagues nearer to us, than it was thought to be before. On the contrary too, from the Heavenly Spaces that had been made too ſmall, the Terreſtial had been computed too large, a natural Conſequence of our Situation, and of the firſt Prejudices.

In 1695, Monſ. *Caſſini* made a Voyage to *Italy*; at another time perhaps we might have apprehended ſome Returns of Tenderneſs for his own Country. But as after the Death of Monſ. *Colbert*, he had withſtood very preſſing and very advantageous Offers made him by the Queen of *Sweden*, who would have called him back thither; we were ſecure of his Fidelity to his new Country. He took with him the only Son that remained, and who is at preſent a Member of the Academy; another of his Sons had been killed at Sea the ſame Year, in an Engagement with an *Engliſh* Ship whilſt he boarded and took her. Monſ. *Caſſini* did not fail to make a Viſit to his Meridian of St. *Petronia*, which wanted him. The Vault which admitted the Sun was ſunk, and the Hole that had been made in it was no longer perpendicular, as it ought to be. Monſ. *Guglielmini* had remedied that Diſorder; but ſince then the Pavement upon which the Meridian was drawn had loſt its exact Level. In ſhort, Monſ. *Caſſini* arrived there ſeaſonably to repair his firſt Work, and the only one he had left to *Italy*. He was willing to extend his Cares to Poſterity, and therefore deſired Monſ. *Guglielmini* to Publiſh an Inſtruction of all that was neceſſary to be done for the Conſervation and Reparation of this great Inſtrument. Monſ. *Guglielmini* did ſo, and therein made mention of Monſ. *Caſſini*, as a Scholar would have done of his Maſter.

This Meridian of *S. Petronia* was the 600000th Part of the Circumference of the Earth; but there was another undertaken in *France* which would be the 45000th Part of the ſame Circumference, and which conſequently would give the Meaſure o the ſame Diameter of the Earth with ſuch an ex- actneſs, as was never heard of, nor hoped for 'til now, but which is the Neceſſary and only Foundation of all the Aſtronomical Meaſures: 'Tis the famous Meridian of the Obſervatory, begun by Monſ. *Picard* in 1669, continued by Monſ. *de la Hire*, in 1683, on the North ſide of *Paris*, and on the South by Monſ. *Caſſini*, and at laſt carried on by the ſame Monſ. *Caſſini* in 1700, to the extream parts of *Rouſſillon*. Monſ. *Caſſini* has had the honour of finiſhing it; ſole Author of the Meridian of *Bologna*, and Author of the greateſt part of that in *France*, the two fineſt Monuments that Practical Aſtronomy has ever raiſed upon Earth, and the moſt Glorious for the Induſtrious Curioſity of Men.

Our Hiſtories of 1701, and 1704, have taken notice of that which was done at *Rome* about the *Gregorian Calendar*: The Pope order'd that the Congregation of Cardinals, to whom that matter was refer'd, ſhould conſult Monſieur *Caſſini* about it; *Italy* ſeemed to require back of *France* what ſhe had given to her; and *France* upon this occaſion received in the Place of Monſieur *Caſſini* a Perſon formed by his Hands, which was his Nephew Monſieur *Maraldi*, who having a great Taſt and Inclination to the Sciences, and particularly to Aſtronomy, came in 1687 into *France* to be with his Uncle, who was ſo capable of teaching him. When the Buſineſs of the Calendar was in Agitation at *Rome*, Monſieur *Maraldi* was there, and the Pope aſſociated him to that Congregation, which ſtood in need of a Man that could bring Monſieur *Caſſini*'s Spirit along with him.

Beſides all that we have related concerning him, he has enriched Aſtronomy with a great number of fine and ingenious Methods, ſuch as *the Invention of the Longitudes in* 1661, *by the Eclipſes of the Sun*, which it was not thought could ever have been applied to that purpoſe; *the explaining the Libration of the Moon, by the Combination of two Motions*, one of which is that of a Month, and the other is made about its Axis in a time pretty near equal; *the manner of finding the true Poſition of the Spots of the Sun upon its Globe*; that of *deſcribing kinds of Spirals, which repreſent all the apparent Odneſſes of the Motion of the Planets, and point out their Places in the Zodiac day by day*; beſides ſeveral others, which may ſerve for future Aſtronomers, as ſo many Means of attaining to his Knowledges, altho' they ſhould not come up to his Capacity.

He underſtood the Heavens not only as they are in themſelves, but ſuch as they have been conceived by all thoſe who have ever formed any Idea of them. If there happened to be in an Author, that did not at all treat of Aſtronomy, any Paſſages that had the leaſt relation thereto, they never eſcaped him. All that was writ upon that Subject ſeemed to belong to him; and were it never ſo much concealed, he found it out and challenged it.

In the laſt Years of his Life he loſt his Sight, a Misfortune common to him with the great *Galileo*, and perhaps for the ſame Reaſon, for nice Obſervations require a great effort of the Eyes. *According to the Humour of Fables, theſe two great Men that have made ſuch Diſcoveries in the Heavens,* *may be compared to* Tireſias, *who was ſtruck blind for having pried into ſome of the Secrets of the Gods.*

Monſieur *Caſſini* died the 14*th* of *September* 1712, at the Age of 87 Years and a half, without Sickneſs, without Pain, and thro' the ſole neceſſity of Dying; he was of a very Healthy and Robuſt Conſtitution; and tho' the frequent Watchings, neceſſary in Obſervations, are dangerous and fatiguing, he had never been acquainted with any ſort of Infirmity. *The Conſtitution of his Mind was juſt like that of his Body, even and tranquil, free from thoſe vain Inquietudes and fooliſh Agitations which are the moſt painful and moſt incurable of all Diſeaſes; even his Blindneſs did not deprive him of his accuſtomed Eaſineſs and good Humour: A great Stock of Religion, and what is yet more, the Practice of it, did very much contribute to this perpetual Calm of his Soul. The Heavens, that declare the Glory of their Creator, never ſpoke more intelligibly thereof to any Body than to him; nor was any one ever more convinced of it: Not only a certain Circumſpection, pretty uſual to thoſe of his Country, but alſo his natural and ſincere Modeſty would have made even the moſt envious Tempers pardon his Talents and Reputation; one obſerved in him that Candor and Simplicity which is ſo amiable in great Men, and yet it is more common to them than to others. He communicated, without ſcruple, his Notions and Diſcoveries, at the hazard of ſeeing himſelf robbed of them, being more deſirous of rendring them ſubſervient to the promoting the Sciences, than to his own Glory. He communicated his Knowledges, not out of vain Boaſting but to make others Wiſer. Finally, one might apply to him, what* *he has obſerved himſelf in ſome of his Works, that* Joſephus *ſaid of the Old Patriarchs:* That God had granted them a long Life, as well for the reward of their Virtue, as for affording them occaſions of rendring Geometry and Aſtronomy more perfect.

His Place of *Penſionary Academiſt* is ſupplied by Monſ. *Caſſini* his Son.

Philoſophical Diſſertations

Extracted from the WORKS

Of thoſe Learned Men, whoſe LIVES are Publiſhed in the Firſt PART, and from thoſe of ſeveral other ACADEMISTS ſtill living.

PART II.

A Philoſophical Diſſertation upon TEETH.

MOnſieur *de la Hire* the Younger, has obſerved that in Adult People, the Bone of the *Tooth* grows no more, (which is alſo the Caſe of all other Bones) but only the Scales or Enamel, as he calls it: This is certain, that the *Teeth* of an Old Man taken out of their Sockets, are no longer than thoſe of a young or middle-aged Man.

The Scales of the *Teeth* are a Subſtance quite different from the Bone; they are compoſed of an infinite number of little Fibres or Threads which are faſten'd to the Bone by their Roots, in a manner like Nails and Horns. This Conſtruction is eaſily ſeen in a broken *Tooth*, in which one may obſerve that all theſe Fibres which take their riſe near that part of the Bone that touches the Gums, are much inclined to the Bone, and as it were lying upon each other; ſo that they are almoſt perpendicular upon the Baſis of the *Tooth*, by which Means they are better enabled to reſiſt the Effort they are obliged to make in that Part.

Monſieur *De la Hire* is of Opinion, that the Increaſe of theſe Fibres is made after the ſame manner as that of the Nails. If by any Accident a little Part of the Enamel or Scale is broken, ſo that the Bone be left naked, that is to ſay, the Roots of the Fibres of the Scale be carried away, the Bone will grow rotten in that place, and the *Tooth* muſt abſolutely periſh, without any poſſibility of ſaving it, for the Bones in Animal Bodies can never bear tobe naked.

There are, however, ſome People the Scales of whoſe *Teeth* are worn out, perhaps with much rubbing them, the Bones of which appear without Periſhing: But the reaſon of that is, becauſe they are not actually naked, and becauſe there does ſtill remain a very thin Scale ſufficient to preſerve them. But the Layer is ſo thin as to be traſparent, and you may ſee the Yellow Colour of the *Tooth* through it.

Sometimes the *Teeth* are broken, and the Bone expoſed without any Inconvenience; but the Reaſon of that is, becauſe they are ſtopt, that is to ſay, the Root of the *Tooth*, into which a little Branch of the Nerves come, being entirely ſtopt, all Communication between that Branch and the Source of the Nerves is interrupted, and conſequently all Senſation. The *Teeth* are not thus ſtopt but in Old People.

It may happen that in ſome *Teeth*, the Fibres which compoſe the Scale, are only united in the extream Parts, but not exactly next the Bone, as appears plain enough in the Baſis of thoſe *Teeth* that are called the *Grinders*, in which you may ſee the Separation of the *Lamina*; but the extream Parts of the Fibres being worn away by little and little, if the Separation between two *Lamina* ſhould be made large enough to receive any of the little hard Particles of the Food, that will cauſe a little Hole in the Baſis of the *Tooth*, and conſequently the Bone being uncover'd will periſh in Time; this may be a little helped, by ſtopping the Hole with Lead, which hinders the Acrous Food from penetrating to the Bone, and cauſing Pain in it.

Upon the Feathers of BIRDS.

A Philoſopher might be a long time Examining the minuteſt Objects in Nature, without being able to exhauſt them. You will be convinced of this Truth by the following Reflections, which the *Feathers* of *Birds* have ſuggeſted to Monſieur *Poupart*, and which would have been much more numerous if he had traced the Matter as far as it would have led him.

Feathers are nouriſhed by the Blood, and the Lymph or watry Humour; this will appear in diſſecting, with a little Care, any one of the great Feathers of a large Young Bird, that has ſtill its *Down*; but there is yet a more eaſie way to diſcover it, for if you ſqueeze the ſame Feather from one end to the other, you may make the Lymph and Blood drop out of it.

The Bird muſt be Young, as well as the Animal, in which you would obſerve how the Bones are nouriſhed. The Veſſels in the Feathers and the Bones are dried up viſibly, and the Mechaniſm diſappears proportionably as thoſe Parts grow more perfect.

At the End of the Tube of the Feather, is a little Hole, by which the Blood-Veſſels enter, after the ſame manner as they enter into a *Tooth*, by a little Hole which is at the extream Part of the Root. That dry and light Subſtance, which is found within the Tube or Quill of a Feather, when it is cut to make a Pen of it, is in Young Birds a great Fleſhy Channel, like a Vein filled with Lymph, about which the Blood Veſſels, which enter into the end of the Tube, creep and divide themſelves into a thouſand little Branches. But if you would know what this large Carnous or Fleſhy Channel is, you muſt not examine it in Young Birds, but in the grown ones; the Point of View, in which you muſt place your ſelf, is no longer the ſame.

In grown Birds we may obſerve this Channel to be compoſed of ſeveral little Bags or Sacks tranſparent, ranged one above another, and diſpoſed in ſuch a manner, that the Bottom of the Lower is joyn'd or faſten'd in the Mouth of the Upper, and ſo on quite to the Top of the Quill. But when you come near to the Beards of the Feathers, theſe little Bags become like Tunnels, at leaſt in ſome kinds of Birds, as in Turkeys. The Tube of the Lower Tunnel inſinuates it ſelf into the Caſe of the Upper, and is faſtened to the Bottom of it; and the Tube of the laſt Tunnel enters into the Marrow of the Feather.

The Blood Veſſels diſcharge their Lymph or Water into theſe little Bags, and from thence they are filtrated, even to the Top of the Quill, and ſo enter into the Pith of the Feather, which being nothing but a ſpongy Matter, eaſily ſucks it up, and diſtributes it on all ſides into the Beards.

In Turkeys this Pith, or Marrow, is nothing but a Collection of an infinite Number of little Channels, which are obvious enough, for the Parts of the Organs of an Animal are themſelves Organized, ſo that the Compoſition of the Mechaniſm or ſtructure of Bodies is infinite, and there is hardly room to doubt but that in all other Birds, in which the Channels of the Pith of the Feather are not viſible, they are nevertheleſs to be found, and do perform the ſame Functions.

Monſieur *Poupart* has obſerved, that one ſingle Feather of a *Vulture* with its Down yet upon it, weighed more than ſix other Feathers of the ſame Size that were come to Perfection, ſo much was it loaden with Nutrimental Juices; and from thence he concludes, that as the Feathers are Inſtruments abſolutely neceſſary to Birds in ſeeking for their Food, Nature makes haſt to compleat them, and Labours therein with more Diligence than in the moſt part of her other Works. It would have been a Satisfaction great enough in it ſelf, to ſee, that the hollow of a Quill had been ſo wrought by Nature, as to unite at the ſame time, the Strength thereof with its Suptilneſs and Lightneſs: But we have moreover diſcovered that ſuch a Cavity ſerves for a Magazine to the Nouriſhment which is to be diſtributed throughout the whole Feather, and that the ſame Means anſwers very different Ends at the ſame time.

It is moreover a very curious thing to obſerve the Care taken by Nature, in preſerving the new born Feathers of Young Birds. The Beards of thoſe Feathers are at firſt no more than a kind of Pap, ſo tender and delicate are they; they are therefore rolled up, in a long Cartilaginous Tube, fill'd with Moiſture, to the end, that they might not be expoſed to the Air, which would dry them and cloſe up their Pores in ſuch a manner that they could no longer receive any Nouriſhment: But when they are grown ſtrong enough, ſo as to reſiſt the Impreſſion of the Air, the Caſe in which they were involved, and which then becomes uſeleſs, drys away, and falls off in Scales of its own accord.

Upon INSECTS.

INſects appear contemptible to the Vulgar, who never know how to apply rightly either their Eſteem or Contempt. They are moſt commonly placed under the Claſs of Imperfect Animals; but Philoſophy judges them to be ſo much the more worthy of its Attention, as they ſeem to have been formed by Nature in a very particular Mold.

For it is only they that for inſtance change their Species, and after having crept upon the Ground are exalted into the Air, aſſuming a new and more noble Life. What Monſieur *Homberg* has obſerved upon the odd Coition of thoſe Flyes that are called *Demoiſelle*, may ſerve to teach us what a fruitful and inexhauſtible Fund of Mechanical Inventions Nature has produced to attain to all its Ends.

To be of both Sexes at once, and to perform the Functions thereof at the ſame time, ſeems to be what is reſerved hitherto for Inſects only. Monſ. *Poupart* gives us a Catalogue of all the Kinds in which he aſſures us this Singularity is to be found. Such are *Earth-worms*, *Worms found in humane Bowels, and in thoſe of Horſes*; *Land-Snails, and thoſe*

thoſe of freſh-water; and all Kinds of Leaches; and for as much as all theſe Inſects are Reptiles and have no Bones, Monſ. *Poupart* concludes, that probably all others of the ſame Character are likewiſe Hermaphrodites; for tho' Nature delights ſo much to vary the Kinds of Animals; yet ſhe preſerves enough of Uniformity among the Species of the ſame Kind, eſpecially with reſpect to their principal Characteriſticks.

Not but that there are ſome creeping Inſects without Bones that are not Hermaphrodites, ſuch as thoſe that produce Flyes, Silk-worms, and other Animals: And theſe are ſo far from being Hermaphrodites, that they are of no Sex at all, and to ſpeak properly, they ought not to be called Animals, being only Caſes or Masks, in which real Animals are involved and hid, and out of which you ſee them ſhortly iſſue, adorn'd with Wings. If theſe Worms appear ſenſible, perhaps that Senſibility only belongs to the concealed Animal, and not to the outward Caſe. Be that as it will, the Worm which is to become a Butter-fly, is neither Male nor Female, nor does it engender whilſt it is in that State, but waits for its Metamorphoſis.

For an Example of the Obſervations that may be made about the double Sex of Inſects, Monſieur *Poupart* gives us the following, upon the Copulation of *Earth-worms*: Theſe little Serpents ſlide by Pairs into ſuch Holes as are convenient for them, where they adjuſt themſelves in ſuch a manner, that the Head of the one is oppoſite to the Tail of the other; then they approach in a ſtreight Line to each other, and as ſoon as they are joyn'd, a little Protuberance or Button in the form of a ſmall Cone, is thruſt into a little Orifice of the other, and ſo reciprocally. One may ſee very plainly the mutual Inſertion of thoſe little Buttons, if one takes the Worms into ones hands, and ſeparate them gently from each other at the Parts where they are joyn'd, viewing them in a good Light. They couple in Spring, and you find the Biggeſt in fat and moiſt Soils.

As theſe Creatures are Males at one end, and Females at t'other, and their Bodies eaſily folded, Monſ. *Homberg* thinks it is not impoſſible that one Worm ſhould copulate with it ſelf, and ſo become both Father and Mother of the ſame Inſect. *This is a ſtrange kind of Generating; but perhaps it is only our Ignorance that makes it appear ſo ſtrange, and who can tell the Bounds of that Variety with which Nature is pleas'd to inform her Works?*

Upon that Kind of Madneſs which is called HYDROPHOBY.

THE Hydrophoby or Averſion for Water which attends Madneſs, is one of the moſt ſurprizing Symptoms we meet with in any Diſtemper. What Relation, what Connexion can there be between the Poiſon that is conveyed into the Blood by the biting of a Mad Dog, and that Horror for liquid Things that render the ſight of them unſupportable to the diſeaſed Perſon, throwing him into convulſive Motions, and into violent Rage and Fury?

Monſieur *Tauvry* having viſited for ſome Days a Young-man that had been ſo Bit, and whoſe Death he had pronounced Infallible, open'd him, tho' in haſt, and endeavour'd to diſcover by Diſſection ſomething that might have relation to this Hydrophoby.

The inſide of the *Œſophagus* was inflamed, the *Trachea* likewiſe a little; at the bottom of the Stomach, there was about three Spoonfuls of a dark, brown pituitous Matter, like that which the Perſon vomited up. The *Gall Bladder* was very full of Bile almoſt Black. The *Pericardium* had very little Water in it. The Arteries were very full of a thin liquid Blood, and the Veins no leſs empty; there was no coagulated Blood found in any Part. After his Death, his Blood would not coagulate in the cold Air, whereas that which was drawn from him a few Days before, was eaſily coagulated. The Brain, and almoſt all its Parts, were much drier than ordinary, and ſo was the Spinal Marrow at its upper part, and all the Muſcles of the Body.

Upon theſe Facts, Monſ. *Tauvry* grounds the following Conjectures: The Spittle and Bile are probably the firſt Liquors that are infected with the Poiſon; the Patient had vomited a mixture thereof which excoriated and inflamed the *Œſophagus*. From thence might proceed his Averſion to any Nouriſhment, whether ſolid or liquid, which he could not take in without Pain; but chiefly to Liquids, becauſe they diſſolved the noxious Salts involved in the Bile and in the Spittle.

It is very likely, that the Nature of this Poiſon is to diſſolve the nutricious and balſamick Parts of the Blood, after which the Body is no longer nouriſhed, and the Veins being dried up for want of Nouriſhment, are cloſed, and do not yield an eaſy paſſage to the Blood which they ought to receive from the Arteries. That Blood being kept in the Arteries too long a while, and in too great abundance is continually beaten, compreſſed, and more minutely diſſolved therein, than it was at firſt by the ſole Diſſolution of its Balſamick Parts.

On one hand the Brain and the nervous Parts are very little moiſten'd by that Blood which has hardly any thing but Spirits in it; on the other, thoſe Spirits fly up towards the Brain in great Quantities, and with an extraordinary Rapidity. It is eaſy to perceive how that produces both Convulſions and Madneſs: The Seat of the Soul being all on fire.

Palmarius by the Account Monſieur *Tauvry* gives of him, affirms, that thoſe who are infected with the Hydrophoby, can't bear the ſight of a Looking-glaſs, or any Thing that is tranſparent; 'tis becauſe thoſe Objects which naturally make a lively Impreſſion, make it at that time too ſtrongly upon a Brain too much extended and inflamed. Waters and other Liquors are Tranſparent and have beſides a Motion that may eaſily diſturb very moveable Organs.

The Syſtem of this Diſtemper, may guide one to the Invention of Remedies, and it is by ſo much the more Lawful to make Experiments in theſe Caſes, as the Death of the Sick man is infallible if nothing be done to him.

Monſ. *Tauvry* is of Opinion, that the hot and ſharp Medicines which are commonly uſed are very

bad,

bad, eſpecially if you except the Sea-ſalt, which may in ſome meaſure maintain the Connection of the Parts of the Blood; nor does he think that Water is good in this Diſeaſe; his Patient always finding himſelf worſe after he had drank of it; it is therefore ſafeſt in ſuch Occaſions to follow the inſtinct of Nature. Probably the Cure might be facilitated by Emeticks, if one could make them ſtay any time in the Stomach; his Patient always found Eaſe after having vomited pretty freely. Perhaps a good Quantity of Mercury might remove the Obſtacles which the cloſing or contraction of the Veins cauſes in the Circulation of the Blood. Perhaps it might not be amiſs to uſe Precipitants, to correct the Acrimony of the Spittle or Bile; after which the uſe of Milk will reſtore to the Blood thoſe nutritive Parts of which it had been diveſted.

This Matter having been debated in the Academy, ſeveral Perſons gave an account of remarkable Cures of the ſame Diſtemper that had fallen under their Obſervations.

Monſ. *Poupart* relates that a Madwoman having been blooded till ſhe fainted, and afterwards tied in her Chair for the ſpace of a Year, and fed with nothing but Bread and Water, recover'd: Monſieur *Berger* affirmed, that among ſeveral Perſons that had been Bit, Two were cured by being blooded in the Forehead, but that the reſt died; Monſ. *Du Hamel* ſaid that Salt-water applied to the Wound was ſufficient.

There were likewiſe Inſtances given of People that had been cured of their Horror for Water, by pouring great Quantities of Water upon them;

and particularly of one Man whom they had tied to a Tree, and thrown 200 Pailes of Water upon his Body, without any other Preparation.

But the beſt circumſtantiated Account, was Monſ. *Morin*'s, about a young Woman of Twenty Years, who had been bit in the Hand by a little mad Boy. She had all the Accidents of Madneſs, and at laſt 16 Days after the biting, they put her into a large Bath of River-water, which was rather cold than warm, and in which they had diſſolved a Buſhel of Salt. She was thrown into it quite Naked and then taken out again, and this was repeated ſo often, 'till ſhe was extreamly tired therewith; and ſo they left her ſitting in the Bath and quite ſtunned. When ſhe came to her ſelf, and looked upon the Water in which ſhe was ſitting, ſhe was amazed that ſhe could ſee it without any Emotion.

After this, there happen'd nothing but what was common in her Diſtemper. She had a Fever, which was handled according to the uſual Method. She had frequent Inclinations to Vomiting, the Phyſicians helped Nature, and ſhe found Eaſe by thoſe Evacuations. In ſhort, they made a perfect Cure of her, and her whole illneſs did not laſt above a Month. Monſ. *Morin* took this Account out of the Journal of Monſ. *Raoult*, Surgeon to the Hoſpital called *L'Hôtel Dieu*, who had attended the Patient during all the time ſhe was ill.

It ſeems that the Imagination ſo furiouſly ſhockt with Water, and all other Liquid matters being once ſubdued and brought to endure thoſe Objects with Patience, the greateſt Difficulty of the Cure is ſurmounted; as well becauſe the Spirits being no longer irritated and inflamed at the Sight of them, ceaſe to carry the Diſorder throughout the Body, as becauſe the diſtemper'd Perſons do thereby become more Tractable, and do more readily ſubmit to the Medicines and Diet that are moſt proper for them.

Upon the PARALLELISM *of the* TUFFT *of* TREES, *with the Sun which they ſhade.*

IN Proportion as our Eyes are adapted to make Obſervations, Miracles encreaſe and multiply upon us. In ſeveral Fruit-trees, ſuch as that of the Apple, Pear, Cheſnut, and generally in all thoſe that imitate their manner; as Walnut-trees, Oaks, *&c.* the Baſis of their Tufft does almoſt always affect to be parallel with the Plain from whence the Body of the Tree iſſues, whether that Plain be Horizontal or not; or whether the Trees themſelves be perpendicular or inclining to an Angle with their Plain; and this affectation is ſo conſtant, that if a Tree grows in a place where the Plain is on one ſide Horizontal, and on the other inclining to the Horizon, the Baſis of the Tufft will likewiſe be Horizontal on one ſide, and on the other incline it ſelf towards the Horizon in the ſame proportion as the Plain does.

Theſe Facts have offer'd themſelves to a great many Eyes that were not capable of obſerving them; but they could not eſcape the Vigilancy of Monſ. *Dodart*, who knew how to conſider them with Admiration; and having enquired into the Cauſe he has formed the following Conjectures.

In the firſt place, he obſerves that the branched Roots follow the Surface of the Plain out of which the Tree ſprings, in whatever Poſition that plain is; and that they rarely extend themſelves but between two Earths where they meet both with their Subſiſtance, and with leſs oppoſition than if they thruſt themſelves downwards. Conſequently the Projection of the Roots ought to be accounted parallel with the Plain on which the Tree ſtands.

He next conſiders the Roots, the Trunk and the Branches, as compoſed of the ſame Fibres ſtrait and parallel among themſelves, and which are extended from the extreameſt Parts of the Roots along the Trunk quite up to the ends of the Branches.

In this Suppoſition, theſe Fibres do neceſſarily make two Folds or two Angles, one at the Neck of the Root, the other at the Neck of the Branches. Since then the Roots are always parallel with the Plain that bears the Tree, if the Tree be perpendicular to the Plain, it is ſo likewiſe to the Projection of the Roots; if it be inclined to the Plain, it is equally ſo to this Projection. It is clear, that in the firſt Caſe, the Fibres, ſuppoſing them continued from the Extremity of the Roots quite up to that of the Branches, make on one part, and on the other, two Right Angles with the Neck of the Root; and in the ſecond Caſe, two Angles, one whereof is Obtuſe, the other Acute.

The only Queſtion is to know, why the Baſis of the Tufft of the Trees is always parallel to the Projection of the Roots, and why, when this Projection makes with the Body of the Tree two unequal Angles on the one Side and on the other, the Tufft of the Branches makes with the ſame Body the ſame Angles diſpoſed alternately, as it is neceſſary for the ſake of the Paralleliſm.

Touching that Queſtion, Monſ. *Dodart* is of the following Opinion: On the ſide where a Tree makes an Obtuſe Angle with its Plain, and conſequently with the Projection of its Roots, a Fibre proceeding from the Extremity of the Root, and continued to the Extremity of a Branch, does neceſſarily make the ſame Obtuſe Angle at the Neck of the Root. If it ſhould likewiſe have made an Obtuſe, or even a Right Angle only at the Neck of the Branches, it is plain, that it ought to be much longer. Now the Fibres of the Wood may be eaſily bent, but can't be extended; wherefore that Fibre, which made an Obtuſe Angle at the Neck of the Root, muſt at the Neck of the Branches, and on the ſame ſide make an Acute one, that being the Complement of the Obtuſe, that it may not increaſe its length, and to preſerve its ſelf in the ſame Condition, as if it had regularly made two right Angles at the two Necks. The acute Angle of the Branches being the Complement of the Obtuſe of the Roots of the ſame ſide; it is plain that the Branches and the Roots are parallel.

On the other Side, where the ſame Tree being inclined makes an acute Angle with its plain, and where a Fibre makes one likewiſe with the Neck of the Root, it is certain by the Phenomenon in queſtion, that it makes an obtuſe Angle at the Neck of the Branches. But it is not eaſy to explain this obtuſe Angle, why this Fibre being in ſome meaſure looſen'd by the acute Angle it makes at the Neck of the Root, ſhould recover it ſelf to make an obtuſe one at the Neck of the Branches? What obliges it ſo to do? Why does it not perſiſt in its State of Releaſement, and why does it not make a ſecond acute Angle at the Neck of the Branches?

Monſ. *Dodart* who raiſes this Objection, anſwers it thus: That on that ſide of the Tree the inclination or bent formed by the Fibres laid upon each other from the Centre of the Tree quite to its Bark, is by ſo much the leſs Acute, leſs cloſe and leſs round, as the Fibres come nearer to the Centre; that thoſe which are the neareſt to the Surface may indeed be more relaxed or looſe, but that the others which embrace them are ſtretched by the greatneſs of the bent, and that conſequently they tend to recover themſelves at the Neck of the Branches, and there to make an Obtuſe Angle. It muſt be ſuppoſed that the Fibres which have this Diſpoſition, are much more numerous than the others, whereby they force them to their own Accommodation.

Upon the Salts of PLANTS.

THere are Eſſential Salts of Plants, that is to ſay, Salts that are extracted from them without the Action of Fire; and they are ſo like in their Effects to Salt Petre or Common Salt, that they ſeem to have been ſuck'd from the Earth by thoſe Plants in the very Figure in which they appear, and without having undergon any Change; but on the other Hand, how comes it to paſs that two neighbouring Plants, very different from each other, ſhould be equally well nouriſhed in the ſame Soil if they dont each of them change, and convert to their peculiar Uſes, the Juices which they draw from them? To ſolve this Doubt, Monſieur *Homberg* took ſome good Garden Mold, which he waſhed with ſeveral boiling Waters to diveſt it of all its Salts as far as it was poſſible; then he divided eight hundred Weight of the ſaid Earth, into four equal Parts, and put it into ſo many Pots; he ſowed two of the Pots with an equal Quantity of Garden Creſſes, and the other two with Fennel. Finally he watered one Pot of Creſſes and one of Fennel with Water, in which he had diſſolved ſome Salt Petre, inſomuch that there went at leaſt two Ounces of it to each Pot; on the two others he only beſtowed pure Water.

This was therefore a ſure Method of comparing together two Plants very different, that had drawn nothing but the ſame Salt from the Earth, and at the ſame time, a Plant nouriſhed in a freſh and inſipid Earth, with it ſelf, when nouriſhed in an Earth impregnated with Salt Petre.

The Event made this Compariſon; at firſt, the four Pots throve equally; when the Creſſes arrived at the height of ſeven or eight Inches, Monſieur *Homberg* pulled it up, and found that which was produced by the inſipid Earth to weigh 25 Ounces, and that in the other 27 Ounces $\frac{1}{2}$ there was no difference in the Taſt, but by the Chymical Analyſis the Creſs that was water'd with Nitre, yielded a little more of Active Principles; but the difference was ſo ſmall, that it may paſs only for that which is unavoidable between two Analyſes.

Monſieur *Homberg* ſuffered the Fennel to grow much longer than the Creſs, and the difference was much greater between the two Pots of Fennel than between thoſe of the Creſſes; the Fennel water'd with Nitre was one third Taller, of a much finer Green, and weighed two Pound, whereas the other weighed but 19 Ounces.

Monſieur *Homberg* explains, in a manner probable enough, the very great Difference that happen'd betwen the two Pots of Fennel, and thoſe of Creſſes; which was, that the Fennel grew a longer ſpace of time. When the little Plant, as yet Imperceptible and nevertheleſs compleatly formed already in its Seed, begins to be unfolded, it draws all its Nouriſhment from the very Subſtance of the Seed, till that Subſtance being quite ſpent, the Plant which is now become ſtronger, begins to attract the Juices of the Earth. It was ſhut up with that little ſtock of Proviſion, by which it was to ſubſiſt during ſome time, after the ſame manner exactly, as the *Fœtus*, incloſed with its *Placenta*, is nouriſhed till the Birth, by the Juices it receives from thence.

While two Plants are young enough to live upon their own Seed, their Condition is equal; but when that little Magazine is exhauſted by them both, if they meet with Earth differently diſpoſed, they thrive unequally, and ſo much the more unequally, as they are the longer fed by nothing elſe but thoſe different Earths. This may eaſily be applied to the two Pots of Creſſes and the other two of Fennel.

By the Chymical Analyſes, the difference of the active Principle between the two Pots of Fennel was much greater than that between the two Pots of Creſſes.

The Creſſes, which are of an Alcaline Nature, yielded Principles that were very Alcaline, even thoſe that were water'd with Nitre, in which there is beyond doubt a great deal of Acid.

The Fennel, which is of an Alcaline Nature, yielded a great deal of Acid in all its Principles, even that which grew in the freſh Earth.

From thence it is eaſie to conclude, both that the Earth is never thoroughly diveſted of its Salts by ſimple Waſhings, and that the greateſt Part of the Salts contained in Plants, are there formed, ſuch as they appear to be either by the natural Fermentations they meet with there, or elſe by the different Organs through which they are filtrated.

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Upon the Formation of the VOICE.

FOR the Production of *Sounds*, the firſt thing required, is Air moved with a very great Swiftneſs, for a Sound moves a Hundred and eighty Fathoms in a Second, or the *60th* part of a Minute; that is to ſay, in an Hours time according to the ſame Proportion, it would extend it ſelf as far as 283 common Leagues of *France*, if not ſtopt by any foreign Cauſe. This has been tryed.

All the Conjectures, and all the Phyſical Diſcourſes tend to convince us, that ſuch a Motion cannot be impreſſed upon the Air, but by the brisk and lively Vibrations of the ſmall Parts of the ſonorous Body, which by ſome Cauſe or other, have been put into an Elaſticity or Springineſs.

The diverſity of theſe Vibrations modifies the Sound and makes the different Tones: A great number of Vibrations made at the ſame time produces an acute, or ſharp Note.

It is known that a String always equally ſtretched, makes in an equal Time ſo many the more Vibrations as it is ſhorter; or if its Length is always the ſame, ſo many more Vibrations, as it is more extended. Two Strings of an equal tenſion, the Lengths of which are as 1, to 2, ſound the Octave of each other. If the Lengths are as 2, to 3, as 3, to 4, *&c.* then the Strings ſound a 5*th*, a 4*th*, *&c.* Theſe relations of 1, to 2, of 2, to 3, of 3, to 4; in ſhort, all the relations of Lengths of Strings from whence there reſults the accords or agreements of Muſick, may be called *Harmonical Relations.*

Since the relation of 1, to 2, makes the Octave, that of 1, to4, will make the Double Octave; that of 1 to 8, the Triple Octave, *&c.* and the ſame in the other Relations. And one may ſay, that theſe laſt Harmonical Relations, for inſtance, 1, to 4, 1, to 8, *&c.* are of the diſtance in Compariſon of 1, to 2. Two Strings, the Lengths of which are equal, do likewiſe make different Accords, in proportion to the difference of their tenſion; but it is not upon tenſions that the Subject of this Diſcourſe will chiefly turn. They are regulated in reſpect to the Accords of Muſick by another Proportion than that of the Lengths.

The Sound that ſtrikes our Ear, is not only that which comes directly from the ſonorous Body to us, but likewiſe that, which being gone out of the ſonorous Body has been ſtriking upon all the neighbouring Bodies, and is from thence reflected towards our Ear. For altho' this reflected Sound has more Way to make, before it comes to us, than the direct Sound; the difference of the time is wholly Imperceptible to us in ſmall Diſtances, by reaſon of the extream quickneſs of this Motion, unleſs our Senſation be very nice and fine; inſomuch that it confounds the two Sounds; tho' at the diſtance of ſome ſmall ſpace of Time this Imperfection is even an Advantage, ſince the two Sounds being United do fortify themſelves conſiderably. *The Wiſdom of Nature ſacrifices one Advantage which would be of little uſe to us to another, that is much greater.*

The reflected Sound does ſo much the more ſtrengthen the Direct, as the Vibrations of the reflecting Bodies have made with thoſe of the ſonorous Body in the ſame time, a nearer Harmonical Relation; as of 1, to 2, of 2, to 3, *&c.*

It may even happen that the reflecting Bodies being much more proper to produce Sounds than the ſonorous Body it ſelf is, the Sound which they produce may be ſtronger than that of the ſonorous Body, that the Tone which they take, may ſurmonnt the other's, and render it inſenſible to the Ear, and in ſhort that the Tone that is heard may be that only of the reflecting Bodies, altho' they were not the Origin of the Sound.

Wherefore it is much more likely that the Tone may be compoſed both of that which proceeds from the ſonorous Body, and of that alſo of the reflecting Bodies.

This Syſtem of Sound being ſuppoſed, Monſieur *Dodart* enquires after what manner the humane Voice, and its different Tones are formed.

In our Throat and at the top of the *Arteria Trachea*, or Wind-pipe, which is the Canal whereby the Air enters into the Lungs, there is a little Oval Chink or Cleft, capable of opening it ſelf more or leſs which is called the *Glotta.*

The long Canal of the *Trachea* terminated at its ſuperiour Extremity by the *Glotta*,does ſo much reſemble a Flute, that the Ancients did not ſtick to believe that the *Trachea* produced the Voice, as the Body of a Flute produces Sounds. *Galen* was the firſt that overcame ſo natural an Error, and maintained that the *Glotta* was the principal Organ of the Voice, allowing nevertheleſs to the *Trachea* a con-a conſiderable Share in the Production of Sounds; for *it rarely happens that he who is the firſt undeceived of a vulgar Opinion, can free himſelf entirely from it, and old Prejudices do commonly leave ſome Footſteps upon his Mind.*

But Monſ. *Dodart* conſider'd that Men do not Speak nor Sing neither, but by exploding the Air, and not by admitting it; that then the Air which goes out of the Lungs paſſes from the ſmaller Veſſels of that Part into others always larger, and from thence into the *Trachea*, which is yet much bigger and larger; that conſequently its Courſe becoming ſtill more free and eaſy, and being more than ever ſo, in the *Trachea*, the Air in that Canal will be far from ſuffering the Violence and acquiring the Swiftneſs neceſſary to produce Sound; but as the Orifice of the *Glotta* is very ſmall with reſpect to the largeneſs of the *Trachea*, it cannot come out of the *Trachea* by the *Glotta*, without very much augmenting its Swiftneſs, and precipitating its Courſe; and thus it violently agitates, as it paſſes the little parts of the two Lips of the *Glotta*, puts them into an Elaſtic Motion, and makes them make Vibrations, which are the cauſe of Sound.

This Sound ſo formed, eccho's or reſounds in the Cavity of the Mouth and Noſtrils, and Monſieur *Dodart* obſerves, that all the agreeableneſs of the Voice depends upon this ecchoing; that when one ſpeaks, and at the ſame time ſtops ones Noſe, the Voice becomes very diſagreeable, and that the common Notion that ſpeaking thro' the Noſe is offenſive, is very falſe; ſince on the contrary, the Sound is only then Shocking when the Mouth alone, and not the Noſe, has any ſhare in it.

To the end that the *Trachea* may make the Eccho, it is neceſſary that the Air modifyed by the *Glotta*, in order to become a *Sound*, inſtead of continuing its way from within to without, ſhould return from without to within, and ſtrike upon the ſides of the *Trachea*; but this is what never happens, except in thoſe that have a violent Cough; or that, according to the common Expreſſion, ſpeak from the Belly. In the firſt, the irregular Convulſions of the *Glotta*, ſhut it up when the Air is going to come out, and oblige it to return back, from whence it does not come out again, 'till after it has fortified it ſelf by the Reflexions of the Concavity of the *Trachea*. In the others, 'tis nothing but a habitude aſſiſted perhaps by ſome natural Diſpoſition, and which produces in them when they have a mind to it, that which otherwiſe is only an involuntary accident.

It is true, that in the greateſt part of the *River-Birds*, which have a very ſtrong Voice, the *Trachea* reſounds, but the reaſon of that is, becauſe the *Glotta* is placed at the bottom of the *Trachea*, and not at the top, as in Men.

Thus the Canal, which had paſſed at firſt for the principal Organ of the Voice, will not even be allowed to be the Second, and an Acceſſory, that is to ſay, that which makes the Eccho; and it will only ſerve to furniſh Air like the Bellows of an Organ.

Nothing more remains than to find the Cauſe of the different Tones; and ſince the Organs, which form the Voice are, as one may ſay, Wind-

Inſtruments, Monſ. *Dodart* goes on to enquire what it is that forms the Tones or Notes in Wind-Muſick.

It is poſſible, as we have ſaid above, that the Tone may proceed from the Body that ecchoes, and not from that which ſounds firſt. The *Hautboy* would yield no Sound, if it had not its *Quill*; and if he that plays upon it, by driving the Air thro' the Orifice of that *Quill*, did not cauſe Shiverings and Vibrations in the two little thin and very moveable Leaves whereof it is compoſed. But the Tone does not proceed but from the length of the *Hautboy*, and the Air agitated by the *Quill* in the Concavity of the Inſtrument, ſtrikes the internal Sides of it, ſhakes the Fibres of the Wood diſpoſed length ways, makes them ſhiver, and exerts a lower Tone when they are longeſt, and a higher when ſhorteſt.

The *Quill* has nevertheleſs a Tone of it ſelf, but the direct Sound which it renders being very much exceeded by the infinite number of Reflexions which the Concavity of the Inſtrument produces, all that is required of Art to do in the Matter, is, that the Tone of the *Quill* ſhould not make a Diſſonance with that of the *Hautboy*, but that it ſhould agree with it, according to ſome remote Harmonical Relation; for in this caſe there can be no other, and that thereby it ſhould ſecond and fortifie it as much as poſſible. The Players upon the *Hautboy* cannot find this Proportion, but by feeling ſoftly. So likewiſe in the Stops called *Biſeau de l'Orgue*, it is a *Quill* which makes them Speak, and the Length alone of the Pipe gives them the Tone.

There are on the contrary two Stops of the *Organ*, the *Regal* and the *Humane Voice*, where the *Quill* alone gives the Tone by the length of its Motion; and it is neceſſary that the Pipe ſhould agree with it, according to ſome remote Muſical Proportion, which thoſe who make *Organs* cannot yet diſcover by any exact Rules.

In the great Stops of the *Quill* of the *Organ*, *la Trompet*, *la Cromhorne*, and *le Clairon*, the Tone proceeds equally, both from the Dimenſion of the Tube or Pipe, and from that of the *Quill*. But in ſhort, what can one find in the natural Inſtrument, which produces the Voice like that which makes the Tone in all theſe different Inſtruments?

One cannot, according to this Analogy, attribute the Tone but to the *Mouth* and *Noſtrils*, which make the *Eccho*, or to the *Glotta* which makes the *Sound*; and as all the different Tones are produced in Men by the ſame Inſtrument, the Part producing them muſt be capable of Changes conformable to them.

There is more Air required for a low Tone than a high one; the *Trachea*, to facilitate the Paſſage of this greater quantity of Air, dilates and ſhortens it ſelf; and in ſo doing, it lengthens the Canal of the Mouth. On the contrary, for a high Tone, it narrows and lengthens it ſelf, and ſo allows the Canal of the Mouth to be ſhorten'd.

One might then ſuppoſe that the Canal of the Mouth being lengthen'd for the grave Tones, and ſhorten'd for the ſharp ones, is exactly diſpoſed as it ſhould be for the Production of Tones.

But Monſieur *Dodart* obſerves, that in the *ſtop* of the *Organ* called the *Humane Voice*, where the *Quill* alone makes the Tone, the longeſt Pipe has Six Inches, and is not capable of giving the Tone. The Concavity of the Mouth of a Man that has the loweſt Baſe, is not above Six Inches in Depth; it is not therefore likely, that that can give the Tone; there remains then only the *Glotta* that muſt form the Tones, as well as the Sound; and that can only be by the different Changes of its Orifice. It is *Oval*, and capable of Extenſion to a certain Degree, as alſo of Contraction, and thereby the Fibres of the Membranes which compoſe it are lengthen'd out for the Low and Baſe Tones, and ſhortened for the High and Treble ones.

At the ſame time the Mouth which is lengthen'd for the Low Tones and ſhorten'd for the High, adapts its Reſounding to all the different Tones, at leaſt according to ſome remote Muſical Proportion; and *Nature too wiſe to neglect any thing, has made an advantage even of this Reſounding.*

The Conſtruction of the Teleſcope reſembles the Structure of the Eye; ſpeaking Trumpets ſeem to be form'd upon the ſame Plan as the Concavities of the Ear; but no Wind Inſtrument, that ever came out of the Hands of the Artificer, is of the ſame Structure with that which Forms the Voice of a Man; none of them can produce their Tones by Changes made in one and the ſame Orifice.

It ſeems even as if Nature intended to place this Inſtrument above and beyond all kind of Imitation. In the firſt Place, it would be difficult to find, in the Hands of Art, any Materials ſo flexible as that one could make in them an Orifice capable of being changed every Moment; and as the Changes muſt be, for every Tone or Note, exceeding nice and exact, the Difficulty would be invincible; but beſides, when we ſhall ſee by an exact Calculation of Monſieur *Dodart*, that for all the Tones and Demi-tones of an ordinary Voice, for all the ſmall parcels of a Tone, which may ſerve to raiſe an Octave without any Violence (for the more or leſs Force that one may give a Sound without changing the Tone, one muſt neceſſarily ſuppoſe that the little Diameter of the *Glotta*, which is at leaſt the Breadth of one Line, and which alters its Length in all theſe Changes, may be, and is actually, divided into 9632 Parts) that even theſe Parts are not equal, and conſequently that ſome of them are much ſmaller than the $\frac{1}{9632}$ part of a Line; how is it poſſible that the Art of Man can ever attain to ſuch nice and delicate Diviſions; and it is ſurpriſing, that even Nature it ſelf can perform them. On the other hand, it is no leſs wonderful that the Ear, which has ſo juſt a Senſation for Tones, can perceive a Difference, the Origin of which is no more than the $\frac{1}{9632}$ part of leſs than one Line.

In this whole Calculation Monſieur *Dodart* has put every thing upon the loweſt Foot, carefully avoiding the Affectation of *Wonderful*, notwithſtanding which, he could not help bringing his Calculation to ſuch a prodigious Number.

We muſt not believe that the Fibres of the *Glotta*, to take, for inſtance, the Fifteenth or Flagelet of a Low Tone, are to be reduced to half their Length, or do ſhorten in proportion the little Diameter of the Orifice of the *Glotta*. That would be true, if thoſe Fibres did produce the Tones only by their different Lengths, but they do it likewiſe by their different Tenſion. Thus they ſound the *Fifteenth*, without being reduced to half their Length, becauſe they are at the ſame time more extended, and that which is wanting by the preciſe Meaſure, is exactly ſupplied by the Tenſion: But finally they are not more ſtretched than at the ſame time they ſhorten themſelves.

The Shortnings of the little Diameter of the *Glotta* follow all the Changes that happen to them, the number of the 9632 Diviſions of this Diameter ſubſiſts, and the Miracle of the Formation of the Tones increaſes; becauſe a Mechaniſm which depends on the juſt Complication of the Length, and of the Tenſions, of which even the Proportions are different, is more difficult than if it did depend on but one alone of theſe Principles.

But what will it be when one conſiders that the whole Man is a Collection of Miracles, either like thoſe above-mentioned, or of equivalent ones, the number of which is much greater than that of the Diviſions of the Diameter of the Glotta.

Upon what becomes of the AIR *that is received into the* LUNGS.

AT every Reſpiration new Air enters into the Lungs, which mixing its ſelf with the Blood that is carried to the Heart by the Pulmonary Veins, comes out of the Heart again with the ſame Blood, accompanies it into all the Arteries where it is diſtributed, and communicates to it the Impulſion and Swiftneſs neceſſary for the Circulation.

But when that Air is at laſt arrived at the Extremities of the Arteries, and at the Internal Surface of the Skin, *what becomes of it?* For it ought finally to go out of the Body, ſince each Reſpiration bringing new Air into it, there would at length be ſuch a quantity of it, as would ſwell the Veſſels too much, force their Elaſtic Power ſo as to make them loſe it; and would ſtop the Blood, or at leaſt render the Circulation very painful.

There does not appear much difficulty in this Matter; ſince the Pores of the Skin ſuffer the Sudorific Matter to paſs th'ro' them, and eſpecially that of the inſenſible Tranſpiration, which comes out in ſo great a quantity, that it exceeds in one Day only, according to the niceſt Experiments that have been made thereof, all the groſſer Evacuations of ſeveral Days; it is eaſie to comprehend, that theſe ſame Pores may at the ſame time filtrate thro' themſelves ſo fine a Subſtance as that of Air.

As this Suppoſition is very natural, the Philoſophers have probably acquieſced in it, without judging it neceſſary to make any deeper Enquiries into this Subject. *But this is a noble Inſtance of Difficulties that do not occur at firſt Sight, but are only diſcovered by Reflecting, and which coſts ſometimes as much to find, as even the Solution of any other Difficulty.*

If the Air could paſs thro' the Pores of the Skin with Sweatings and Vapours, Monſieur *Mery* asks why it does not likewiſe exhale, when one has ſhut it up in ſome great Tube of a *Vein* or *Artery*, in the *Heart* or in the *Stomach*?

And farther, why Animals ſhould ſwell *in vacuo*? Aſſuredly 'tis the Air ſhut up in their Bodies and delivered from the weight of an External Preſſure, which being rarified, makes them ſwell, and yet that Air ſhould paſs out more freely than ever thro' the Pores of their Skin.

'Tis true, there are ſome Animals that caſt out the Air *in vacuo*, but then Monſieur *Mery* denies that it is by the Pores of the Skin; for inſtance, Air comes out of living Fiſhes, but Monſieur *Mery*, by obſerving that Fact very nicely, diſcovered that it came from under the Scales, where there muſt have been little Receptacles that were not yet known to us; and in effect, the Bodies of Fiſhes do not *unſwell* for having render'd all this Air.

It is plain then, that the Air does not come out by the Pores of the Skin; it muſt be therefore, that coming with the Blood to the Extremities of the Arteries, it enters with it into the little Mouths of the Veins, follows it all the reſt of the Circulation, and goes into the Ventricle of the Heart, from whence it returns into the Liver by the Pulmonary Artery, whereas it came into it by the Veins. From theſe Arteries it re-enters into the little Veſſels of the Liver, and goes out at laſt by the *Trachea* which brought it in, at firſt; this Courſe is not only proved by the neceſſity of Reaſoning, but likewiſe by Experience, and by Blowing.

If one conſiders final Cauſes, and if one dares gueſs at the Intention of Nature, the Air is not leſs neceſſary to the Blood of the Veins, than it is to that of the Arteries; it even appears to be more ſo, the Veins have hardly any Elaſticity or Springineſs in compariſon of the Arteries, and yet they contain almoſt half as much more Blood, and conſequently they have ſtill more need of a Foreign Strength to help on with its Motion.

The Air being weaken'd, and in ſome manner worn out by its Circulating throughout the whole Body, has nothing more to do afterwards, but to get out, and to give place to a new and more vigorous Air.

Upon SUBTERRANEOUS FIRES, EARTHQUAKES, THUNDER, &c. *Explained Chymically.*

THE beſt way to explain Nature, if it could be often made uſe of, is to ape or counterfeit her, and to give Repreſentations of her, by making Cauſes that are known by us to produce the ſame Effects; then we ſhould no longer gueſs, we ſhould ſee with our own Eyes, and we ſhould be ſure that the Natural Phænomena do ariſe from the ſame Cauſes as the Artificial, or at leaſt from Cauſes very near a-kin to them.

Thus Monſieur *Lemery* made an *Ætna*, *Veſuvius*, or Burning-Mountain, have incloſed in the Earth about a Foot deep, in Summer time, 50 Pounds of a mixture of equal Parts of the filings of Iron and of Sulphur pulveriſed, the whole being made into a Paſt with Water; at the end of 8 or 9 Hours the Earth ſwelled and opened a little in ſome places, out of which proceeded hot Sulphry Vapours, and afterwards Flames.

It is very eaſie to conceive that a larger Quantity of this Mixture of Iron and Sulphur with a greater Depth of Earth was all that was wanting to make a real Mount *Ætna*; that then the Sulphurious Vapours making their way out would have cauſed an *Earthquake*, more or leſs violent. in Proportion to their Strength, and to the Obſtacles they would have met with in their way; that when they had found or forced an Opening, they would have ruſhed out with an Impetuoſity great enough to produce a *Hurricane*; that if they had broke out from any Part of the Earth lying under the Sea, they would have made thoſe Spouts or Columns of Water ſo dreadful to Ships, and finally if they had riſen up as high as the Clouds, they would have carried their Sulphur thither, and turned it into Thunder and Lightning.

It ought not to appear ſtrange that this Sulphur plunged into the Water of the Clouds, does notwithſtanding take Fire. The Sulphurious Matters do not naturally mix with Water, but if they are very much exalted, they will burn in it, witneſs what we call the *Gregeois* Fire. It is true nevertheleſs, that there is always ſome part of this Sulphur which is extinguiſhed, and even with Exploſion or Noiſe.

On the other hand, thoſe Parts of it that burn in the Water make an Effort to free themſelves, and to aſcend, and this Effort likewiſe produces a violent Noiſe. This Monſieur *Lemery* proves by a new Experiment, where a Sulphurious Vapour riſing from the bottom of a Marſh, being kindled by a Candle that was held in it, as it came out the Flame communicated it ſelf nearer and nearer to all the Vapour that filled the void Space of the Marſh, gained the bottom, and catched a Sulphurious Matter that was in the Water, which Matter being inflamed, ſtruck the Water violently to make its way, and ſo produced a little kind of Thunder. If the Flame does not reach to the bottom of the Marſh where the Sulphurious Matter is in the Water, the inflamed Vapour having nothing to fight with, makes no Fulmination.

Upon the Fœcundity of PLANTS.

ONE of the Wonders that are obvious enough to the Eyes of all the World, and yet obſerved by few, is the Fruitfulneſs of Plants; not ſo much their natural Fruitfulneſs when left to themſelves, as their artificial Fruitfulneſs, occaſioned by Pruning and Cutting off ſome of their Parts. This artificial Fertility, is not really different from the natural; for in ſhort, the skill of the Gardiner cannot communicate to Plants what they had not before; he only helps to Unfold and to bring to Light that which was actually in them. Monſieur *Dodart*, who enquires into this Matter, has not yet given us any Phyſical Syſtem, he only lays down Facts, but Reaſonings and Calculations muſt eſtabliſh them, becauſe the Queſtion is not ſo much what a Plant gives, as what it would give, if one drew from it all that it contains. Here follows an Example of the Fertility of one Tree in the Buſineſs of Seeds only, which are the laſt Term and Object of all the Productions of the Tree.

We know that all the *Branches* of the *Elm* are nothing but Bunches of Seeds very cloſely preſſed together.

Monſieur *Dodart* having choſe, at a venture, an *Elm* of 6 Inches in Diameter, and 20 Foot in

Heighth, from the Root to that Part where the Branches ſpring out, and which might be about 12 Years Old; he cut off one of the Branches of 8 Foot in Length, and ſlighting thoſe Seeds that had been beaten out by the repeated Blows of the Hatchet, and others that were ſhed by the fall of the Branch, he only counted thoſe that remained, and found upon that ſingle Branch 16450 Seeds.

All the Branches that were not ſo long as 8 Foot taken together, made a Surface much more than double the Surface of 10 Branches of 8 Foot. But ſuppoſing them no more than double, becauſe perhaps the leſſer Branches are not ſo fruitful, all theſe Branches taken together would yield 329,000 Seeds.

An *Elm* may eaſily live 100 Years, and the Age of its middle Fertility is certainly not ſo little as that of 12 Years. You may reckon then for one Year of a middle Fertility above 329,000 Seeds, and put no more in the place of that Number, than 330,000, which is very little. But you muſt multiply thoſe 330,000 by the 100 Years of the Life of the Elm, and that will amount to 33,000000 of Seeds, which are the Production of an Elm for its whole Life, at the very loweſt reckoning, and theſe 33 Millions come out of one ſingle Seed.

This is one inſtance only of the Natural Fœcundity of a Tree, which has not diſcloſed all that is contained within it.

If it had been *Lopp'd*, it would have puſhed out of its Trunk again as many Branches as it had in its natural State, and theſe new Sprigs would have come out in the ſpace of 6 Lines of heighth, or thereabouts,

abouts at the Extremity of the Trunk that was lopp'd.

In what part or at what heighth ſoever the Tree had been lopp'd, it would always have ſprung out equally, which appears conſtantly by the Example of the Dwarf-Trees, that are cut almoſt level or even with the Earth.

The whole Trunk from the Ground up to that part where the Branches come out, is therefore quite full of Principles or little Embrio's of Branches, which indeed can never appear all at once, but which being conceived as divided by little Circular Rings of 6 Lines in Heighth, compoſe ſo many Rings, each of which in particular is ready to appear, and will really come forth as ſoon as the Lopping is made exactly above it.

All theſe inviſible and conceal'd Branches do not leſs really exiſt than thoſe that are diſcloſed; and if they did appear, they would likewiſe have an equal number of Seeds, which conſequently they muſt already contain in little.

Wherefore, according to the Example propoſed, there are in ſuch an *Elm* as many times 33 Millions of Seeds, as 6 Lines are contained in the heighth of 20 Foot; that is to ſay, 1584,0000000 of Seeds, and this Tree does actually contain within it wherewithal to multiply and re-produce it ſelf ſuch a ſurpriſing number of times. *The Imagination is frighten'd to find it ſelf carried ſo far by Reaſon.*

But what will it be then, if one comes to conſider that each Seed of a Tree, does it ſelf contain a a ſecond Tree, which alſo contains the ſame number of Seeds; that one can never arrive, neither at one Seed which contains no more Trees, nor at one Tree containing no more Seeds, or that has leſs than the foregoing; and that conſequently there is an encreaſing Geometrical Progreſſion whereof the firſt Term is 1. the ſecond 1584,0000000, the third the Square of 1584,0000000, the fourth its Cube, and ſo on *in Infinitum*?

Our Reaſon and Imagination are equally loſt and ſwallowed up in this immenſe Calculation, and what one may call in ſome manner more than immenſe.

We ſhall find that Monſieur *Dodart* to avoid the Affectation of *Wonderful*, or perhaps to affect it more inſenſibly, has in reſpect of ſome Articles made his Calculations of the Fœcundity of Trees lower than they ought to be, but that Difference is of ſmall importance. A Calculation, which in the utmoſt rigour would be too ſtrong for the *Elm*, would be much too weak for the *Fern*, which is incomparably more Fruitful in Seeds; and in ſhort, *let a Man be as ſparing as he will in his Calculations, he will always arrive at Prodigious Numbers, and at Miracles in Natural Philiſophy.*

Upon the Circulation of the Blood in FISHES.

PErhaps it can never be better proved than by the Subject of this Diſcourſe, that Nature having laid down a certain general Plan, knows afterwards how to diverſifie it in all the different Manners that the particular Applications require.

Air is neceſſary to all kinds of Animals, we take that Truth for granted; they do all therefore take in Air. But there are ſome whoſe Blood is naturally more brisk and fluid; it is ſufficient for that ſort of Blood to go and take the Air in a certain Receptacle, called the Lungs, and from thence dilate it ſelf throughout the whole Body, with the Air wherewith it is impregnated. There are other Animals, whoſe Blood and all their Humours, are ſo groſs and glutinous, that the Air taken into the common Receptacle, and from thence diſtributed into the reſt of the Veſſels, would not ſufficiently animate them; it is therefore neceſſary that they be immediately impregnated with Air. Such Animals are the Inſects, in whom the Canals that convey the Air, that is to ſay, the *Trachea*'s reign from one extremity of the Body to the other, diſtributing their Branches every where, and in ſeveral Sorts; they have even as many external Orifices ſcatter'd about the Body, by which they receive the Air, as there are Rings upon the particular Inſect, which is the Cauſe that if thoſe Creatures are rubb'd with Oyl they immediately die, the Conduits of Reſpiration being thereby obſtructed. This is the firſt difference that there is in the manner of Animals receiving the Air.

If the Animals have Lungs, the general Idea of that Mechaniſm is, that the Blood being extreamly divided, and thereby reduced to have a large Superficies, preſents it ſelf to the Air, which is alſo very much divided; ſo that each minute Particle of the Blood, goes and takes its little Portion of Air. Thus in Men, in four footed Beaſts, and in Birds, the Lungs are nothing but a heap of an infinite number of very ſmall Veſſels or Bladders, that are ſwelled with Air, and each little Veſicle has its exceeding fine Blood-Veſſels, where the Blood receives the Air through the very fine Membranes or Skins of thoſe Veſſels.

The Blood impregnated with Air is to be diſtributed through the whole Body, and it is the Heart alone that does the Office of Receiving and Diſcharging it. If the Animals are deſtined to a continual Action, as moſt part of them are, the Heart has two diſtinct Ventricles, one of which ſerves to receive the Blood, which by circulating has diveſted it ſelf of the Air, and to ſend it back to the Lungs; the other to receive the Blood in its return from the Lungs, and to diſperſe it throughout the Body. Thus all the Blood that waters the Body is laden with Air; but if there be any Animals that are to paſs a conſiderable Part of their Lives without any brisk Motion or Action, ſuch as *Tortoiſes*, *Frogs*, *Serpents*, &c. their Hearts have either but one only Ventricle, or ſeveral that communicate with each other, which is in a manner the ſame thing; ſo that the Blood returning from the Lungs, and impregnated with Air, mingles it ſelf with that which returns from the reſt of the Body, and is diveſted of the Airy Particles, and conſequently the Blood protruded by the Heart through all the Body, is leſs animated and lively.

Theſe are all the Varieties of Reſpiration in Animals that breath Air; but Fiſhes, which live in Water, and which die almoſt aſſoon as they are carried into the Air, how do they reſpire? It is certain, and Monſieur *du Verney* has proved it, that this Air in which they die, is nevertheleſs abſolutely neceſſary to their very Being.

There is always a great deal of Air mixed and involved in Water; 'tis that Air the Fiſhes breath. What we call their Gills, are their Lungs; and the whole Mechaniſm of the Gills has no other end but only to draw this Air encloſed in Water, and to preſent it to the Blood, after the ſame manner, as it is preſented in the Lungs which receive it immediately.

Monſieur *du Verney* has ſtudied and unravelled in the Gills of a Carp, this Mechaniſm almoſt infinite and prodigiouſly complicated.

The firſt Thing that offers it ſelf, is a kind of Carpenter's Work, conſiſting of a very great number of bony *Lamina*, each of 'em ſub-divided into an Infinity of bony Nets; the uſe of all which is only to ſuſtain an innumerable Multitude of the Ramifications of an Artery that proceeds from the Heart. It is plain, that this ſurprizing Quantity of exceeding fine Ramifications ſerves to preſent the Blood extreamly ſub-divided, and as we may ſay, each little Particle of Blood all alone. Among the *Lamina*, and in the whole Contexture of the Gills, there are an Infinity of narrow Intervals or Spaces deſtined to receive like Strainers, and to ſub-divide into very ſmall Particles the Water which the Fiſh reſpires by its Mouth. 'Tis then that the Air, to which in ſome manner, its Priſons are opened, makes its Eſcape from that Water, and goes and joyns it ſelf to the Blood of all the little Arteries. As theſe Gills have neceſſarily an alternate Motion of Dilatation and Compreſſion, which is ſtill performed by other very nice Machines;

as they receive the Water when they dilate themſelves, and expel it again when they are contracted: It is moſt probable that it is at the inſtant of the Compreſſion, that they oblige the Air ſqueezed out of the Water to penetrate the Pores of the ſmall Blood-veſſels; for that inſtant has more Strength than the other, and that Action requires more. This ſame Reaſon has place with reſpect to the Veſiculary Lungs, ſuch as thoſe in Men; and from thence Monſieur *du Verney* concludes, that altho' the Air comes into our Lungs at the Moment of Inſpiration, it does not mix with the Blood, but at the Moment of Expiration, and when a ſuperfluous remnant goes out by the *Trachea.* Thus the real Inſpiration, that is to ſay, the Entrance of the Air into the Blood would become the Expiration.

Carps, as well as ſeveral other Fiſhes, reſpire Water by the Mouth, and caſt it out again by the Gills, after having extracted from it all the Air they can. Herein they differ from other Animals which receive and throw out the Air by the ſame Conduits. Becauſe there is little Air in a great deal of Water, the Number of the ſmall Arteries where the Blood divides it ſelf, muſt be much greater in the Gills of Fiſhes than in the Veſiculary Lungs of other Animals. On the other hand, the Air that is ſhut up in the Water is more confined there, its little Spiral *Laminæ* are more compreſſed therein, than if it were mingled with other Air, conſequently it has a greater Spring; and as it is in proportion to its Spring, that it gives Motion and Impulſion to the Blood, a ſmaller quantity may produce a ſufficient effect in the Fiſhes.

When they are in the Air they die, becauſe the *Strainers* of their *Gills*, which are Paſſes narrow enough for the Water are not ſo for the Air; for that makes its Way too eaſily out of them, and can't be forced to enter into the little Arteries. Theſe Strainers have no Power over the Liquor that percolates them without doing it Violence.

After that the Blood of the little Arteries in the Gills is laden with Air, it paſſes according to the Laws of Circulation into all the little Veins that anſwer the ſaid Arteries; but that which is very ſingular is, that according to the Obſervation of Monſ. *du Verney*, the Veins of the Gills being once gone out of them do preſently become Arteries, and expand themſelves into all the Parts of the Body, from whence other real Veins bring back the Blood to the Heart.

This Metamorphoſes of Veins into Arteries, appears by ſeveral Tokens. 1. The Heart has but one Ventricle, and one Artery which goes ramifying it ſelf, and is loſt in the Gills. What Canals ſhall water the reſt of the Body, and carry into it the Blood vivify'd by the mixture of the Air? 2. The Veins of the Gills, which are nothing but an Infinity of exceeding ſmall and fine Ramifications, carry their Liquor when they go out of the Gills into Trunks that are much bigger, and theſe large Trunks, being diſperſed thro' the reſt of the Body, do again ſub-divide themſelves into little capillary Branches, which would not happen to Veins that were to continue Veins; for they would end by the largeſt Trunks, as the Arteries do by the ſmalleſt Ramifications. 3. At the coming out of the Gills, where Monſ. *du Verney* pretends that theſe Trunks which receive the Blood of the Veins become Arteries, they do effectively take the conſiſtance of Arteries, and have Tunicks or Membranes more ſtrong and ſolid than thoſe of Veins.

The general Plan of Nature, which has order'd that the Blood of a whole kind of Animals ſhould be mingled with the Air in a common Receptacle, does again divide it ſelf into two Branches. The Blood which has paſſed by this Receptacle does either return to the Heart, that diſperſes it again through all the Body, or diſtributes it ſelf immediately therein, as it goes out of the Receptacle of the Air. Perhaps this laſt Mechaniſm was neceſſary for the Fiſhes, becauſe their Blood takes little Air, and that the Impulſion it receives from thence would become too weak if it were obliged to reſume the Circuit of the Heart. If our Notions are true, what a wonderful Variety of Mechaniſm is there with reſpect to our different Wants? And if other Subjects require the ſame Variety, it will doubtleſs be ſtill more marvellous with reſpect to real Wants, than to ſuch as we may have falſely conceived.

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A Second Philoſophical Diſſertation upon the Fœcundity of PLANTS. [Vid. p. 262.]

IN the Hiſtory of the Academy for the Year 1700, you have an account of the Experiments upon which Monſ. *Dodart* had eſtabliſh'd the prodigious Fœcundity of Plants: He did there confine himſelf chiefly to Matters of Fact, having ſcarce meddled with the Phyſical Syſtem thereof; now he proceeds Syſtematically.

A Tree that has been lopp'd, and ſhoots out new Branches, from whence does it fetch them? Monſ. *Dodart* proves, and the thing ſeems of it ſelf extreamly probable, that neither the Trunk of the Tree, which is no more than a Packet of Fibres, or a Heap of Tubes void of all Action, nor the Sap, which like the Blood is deſtined to nouriſh, but not to form the Parts, can produce theſe new Branches; that conſequently they muſt have exiſted before the lopping of the Tree, but in little, and ſhut up in inviſible Buds.

If one had not lopp'd the Tree, the Sap would have continued its courſe in the Branches already formed and ſhot forth, and would not have endeavour'd to have unfolded thoſe that were in the Buds.

If the Body of the Tree had been cut in any other Place, new Branches would have appeared after the ſame manner: Conſequently ſome Buds are there likewiſe, and do incloſe little Branches which the Sap might unfold.

The Body of a Tree may be cut in an Infinity of different places, and all the Wounds will afford new Branches. Such a Body does therefore contain an Infinity of Buds involved in little Branches; But they are not all unfolded, either becauſe there is never a ſufficient quantity of Sap in one only Tree, to bring forth all the Parts that are contained in it; or elſe becauſe thoſe Buds at their ſhooting out hurt one another by their exceſſive Numbers, and that only thoſe which are towards the external Parts of the Tree, have the Liberty of exerting themſelves, becauſe they want the help of the Air for their Vegetation.

Theſe two laſt Cauſes joyned to the Motion of the Sap, which muſt be ſhot up almoſt in a ſtreight Line from the bottom to the top, may give us to underſtand why the principal Production of the Branches is made at the top of the Tree, and why, when the Tree is lopp'd, there are none but the little Buds placed by Nature in thoſe Parts that are cut, that have any Advantage thereby.

An Animal that is contained in its Egg, being once diſcloſed and hatched, is entirely ſo; if he loſes any Members, he loſes them irrecoverably, having no reſerve, tho' he ſhould want it never ſo much. But a Plant does never diſcover all that it contains, and has hidden Riches with which it can repair its Loſſes, and often with advantage too.

A Bud contains the Branch with its Leaves, its Fruit, its Seed, and all that actually exiſting, and even viſible too very often, as ſoon as the Bud begins to unfold it ſelf.

As the Conſequence may frighten Mens minds, Monſ. *Dodart* forgets nothing to render it neceſſary by making good the Principle that produces it: Then he endeavours to render it receivable by it ſelf, and to accuſtom us to the Idea of Infinite: This would be no difficult matter with thoſe that have been uſed to dig in Phyſicks or Mathematicks: They know they can't go far without meeting quickly ſomething of Infinite: *as if the Author of Nature, and of all Truths, had taken care to* *ſtamp all things with his chief Character. But it is certain, that this Notion does at firſt always ſhock common Imaginations.*

Upon the Effects of the Spring of the AIR *in* GUNPOWDER, *and in* THUNDER.

THE Air, which till theſe latter times, ſeem to be nothing elſe but a liquid Matter, almoſt wholly uncapable of Action, is now diſcover'd to be one of the moſt univerſal and moſt violent Agents that there is in Nature. The Strength of Gunpowder for Example, ſo amazing even to Philoſophers themſelves, is nothing but the Power of the Air. There is Air ſhut up, or rather cloſely impriſon'd in every Grain of Gunpowder. There is likewiſe Air filling all the Interſtices between every ſingle Grain, and when the Powder is ſet on Fire, the Springs of all theſe little Maſſes of Air are dilated and looſen'd all together. Theſe Springs are the ſole Cauſe of ſo many prodigious Effects; for the Powder ſerves only to kindle a Fire that puts the Air in action; after which, 'tis the Air alone that is the Soul of all.

Monſ. *de la Hire* is therefore of Opinion, that all the Phenomena of Gunpowder are to be attributed to the Properties of this Elaſticity or Springineſs: Here follow the principal, or at leaſt thoſe that have been the moſt neceſſary to him in his Enquiry.

A

A Spring bent, tends to unbend it ſelf on the two oppoſite Sides with equal Violence. A Spring requires a certain Reſiſtance to exerciſe all its Strength, and it is the leſs active by how much the more the Body againſt which it acts, yields to it, or flies from it. A Spring produces a more ſenſible Effect on one Side, when it meets with reſiſtance on the oppoſite Side.

Upon theſe Suppoſitions, Monſ. *de la Hire* conſiders all the Springs of the Air put in action by the Fire which kindles the Powder ſhut up in the Body of a Cannon: Some Philoſophers have thought that when the Powder was kindled ſucceſſively, its Effort was greateſt at the place where it began to be inflamed, becauſe its force was augmented by that which was kindled afterwards. But tho' this reaſon may be ſpecious, it is not true; for according to the Reflection of Monſieur *de la Hire*, a Spring ſupported againſt another equal Spring which reſiſts it, has all the Strength it can have; and it will not have more, tho' other Springs do ſucceed one another to ſupport it, or to ſupport thoſe that do ſupport it. On the contrary, perhaps the Force of the firſt will be leſſened whileſt the others ſhall be put in motion; and if in that ſpace of time the Body, againſt which they are to act, begins to yield, their Actions will be ſo much the weaker.

It is therefore better that the Springs ſhould be looſen'd or unbent all together, even when one would not make them act but at the place where the Powder began at firſt to be kindled. It is moreover certain that the Powder being kindled all at once, a greater Heat puts the Springs into a greater

Tenſion, and as they all are ſupported mutually at the ſame time, they are capable of a greater effect towards all the Sides. The only Danger is, leſt the Cannon ſhould burſt by a too brisk and ſudden Inflammation of all the Powder, and it is found convenient to make it a little ſlower.

The Cannon being thick enough to reſiſt all the Impulſions that are made from the Axis of the Cylinder of its Body towards the Circumference, there remains only thoſe Impulſions that are made towards the Breech and towards the Mouth of the Cannon. The Springs puſh equally againſt thoſe two oppoſite Ends, from whence it is, that the Cannon recoils, at the ſame time that the Bullet comes out of its Mouth. The ſame Force therefore that cauſes the Recoil, is that which cauſes the Motion of the Bullet. But from whence proceeds it, that the Motion of the Bullet has ſo great an Extent, and the Recoil ſo ſmall a one? The reaſon is, the Cannon has much more Difficulty to move it ſelf backwards, than the Bullet has to move forwards; and as the Force that produces theſe two Effects is equal, the Way which the Bullet makes does ſo much ſurpaſs the retrograde Motion of the Cannon, as the Difficulty it finds in going backwards exceeds that which the Bullet has in moving forwards.

There muſt therefore be a great Reſiſtance to the Recoil of the Cannon, which is always very ſmall, and in effect one perceives at firſt Sight that that Reſiſtance is the Friction or Rubbing that is made againſt the Earth by ſo heavy a Machine as is a Cannon with its Carriage. But there is more in it yet; the Reſiſtance to a Motion is ſo much the greater as the Motion is quicker, and when it is ſo, to ſuch a Degree that that which reſiſts has not time to yield, then a Body weak enough of it ſelf may keep the Place of an immoveable Body, and of an invincible Obſtacle. It is for this reaſon that both the Air and the Water, being ſtruck with ſo much Swiftneſs, and with ſo quick a blow that they have not time to fly, become fixed Points, the one for the Motion of Birds, and the other for the Action of Oars. In like manner, if you hang a Stick by the two Ends to two fine Threads, and ſtrike it in the middle with a very quick blow, you may break it there, and the Threads which ſupport it will remain entire. The reaſon is, the Fibres of thoſe Threads do require a longer time than is given 'em to extend and ſeparate themſelves, and the Air beſides is not able to fly faſt enough from under the Stick, which having been ſuſtained on all ſides by firm Supports, receives the entire Impreſſion of the blow, and ſo is broken.

The extream Swiftneſs, or to ſpeak more properly, the extream Suddenneſs of the Motion impreſſed by the Powder upon the Cannon, ought therefore ſtill to increaſe the Reſiſtance which it finds in recoiling, whether it be on the part of the Earth, or even on that of the Air; if a Cannon were ſuſpended the Experiment ſhews that the Recoil would be very great.

A Sky-Rocket, the Conſtruction of which, I ſuppoſe, is well known, is no other than a little very light Cannon; which by the Effort of the inflamed matter contained in it, recoils in the Air with as much Swiftneſs as the inflamed matter has to come out of the Orifice, which is turned downwards. 'Tis by this Recoil that the Rocket flyes upwards.

The Rocket being filled with all that Matter which belongs to it, if its Centre of Gravity were above the Centre of its Figure, with reſpect to that End that is cloſed, which is that that goes foremoſt, it would happen, for the Reaſons mention'd in the Hiſtory of 1700, that as ſoon as the Rocket begins to raiſe it ſelf, it would make a Semi-circle in the Air, and be turned upſide down; after which it would redeſcend, becauſe the cloſed End of it, which makes the Recoil, would be turned towards the Earth. Wherefore, as it is impoſſible in the Practice to determine certainly the Centre of Gravity and its Poſition with reſpect to the Centre of Figure, there is a much ſhorter and eaſier Expedient made uſe of: They faſten to one of the ſides of the Rocket a Stick, the weight of which is ſuch, that the Centre of Gravity of the Rocket and Stick altogether are a little below the Orifice of the Rocket. If this Centre is below the Orifice or Mouth when the Rocket is filled, it is yet more ſo when it flies upwards, and when by diſcharging the matter it contained it becomes ſtill more light. This Centre therefore changes and deſcends continually in Proportion as the Rocket riſes, and conſequently makes it keep a ſtreight Motion.

Monſieur *de la Hire* owns, for the Glory of thoſe courſe and uncertain Experiments which have produced Arts, that he thinks that the niceſt Speculation could have added nothing to the Conſtruction of theſe Rockets; only he obſerves, that the

Stick being faſtened to one of the Sides, the Centre of Gravity of the whole together can't be in the Axis of the Rocket, that conſequently it can never raiſe it ſelf up very vertically, and that in order to give it ſuch a Direction exactly, it were better to faſten a Stick to each Side, the weight of both which Sticks ſhould not exceed that of the ſingle one.

It is eaſie to apply to Petarero's the ſame Principles which we ſee acting in Cannons and in Rockets. Monſieur *de la Hire* propoſes, that in order to augment the Effect of a Petarero againſt a Gate, or againſt a Wall to which it was faſtened, it ſhould be ſo fixed and planted as to become, if poſſible, immoveable on the oppoſite ſide, thereby its recoil would be prevented and its Force redoubled on the ſide on which it is to act.

Thunder it ſelf is no other than a kind of inflamed Gunpowder; and Men may boaſt, without any Preſumption, that they can imitate it. It is a Compoſition of Sulphur, of Salt-Petre, or ſome other Subſtances very like them, and the Air being put into Motion by their Inflammation, makes the chief Phenomena of Thunder.

If this Air when it dilates and unbends it ſelf meets with no Reſiſtance, we then ſee the Lightning but hear no Noiſe. If it meets with Clouds which oppoſe its Motion, there reſults from thence that Colliſion of the Air which cauſes the Noiſe, and this Noiſe is ſo much the louder as the Clouds compoſed of ſmall Particles of Ice, are leſs proper to receive Motion from a very much inflamed Air. When the Fire of Thunder moves with ſo great a Violence, it bends and compreſſes the Springs of the thick Air wherewith it is ſurrounded, that Air does thereby become capable of reſiſting it, and of driving it backwards; which happening ſeveral times following makes the Lightning appear like ſtreaks of broken Fire.

The Air which is neareſt the Earth being thickeſt and coarſeſt, is that which muſt have the greateſt Strength to reſiſt the Motion of Thunder, that is to ſay, to make it re-mount, and conſequently it muſt happen pretty often that that Flame being repulſed towards the place from whnce it came, is diſſipated without producing any Effect.

We ſee ſometimes Water riſing out of a *Tube*, mount 3 or 4 times higher than the depth of the Baſon or Fountain allows, and ſo it is ſoon reduced to that heighth which the Laws of Hydroſtatics preſcribe it. But how could it go out of it in an inſtant? Monſieur *de la Hire* attributes it to ſome Air ſhut up in the Conduit, which having been preſſed and put into Motion by the Water continually deſcending, diſcharged it ſelf againſt that which aſcended, and communicated to it this momentaneous Swiftneſs. So he believes the Violence of Thunder may be ſometimes augmented by the Air, which after a ſtrong Compreſſion, occaſioned by the Fire of Thunder it ſelf, reſumes its natural Extenſion. *It is impoſſible to follow all the Effects of the Air, it is almoſt it ſelf alone the Soul of the World, if we underſtand by the World, that which we inhabit, and which is neareſt to us.*

Upon the Experiments made by a Convex BURNING-GLASS.

HItherto Chymiſtry has not employed in the Decompoſition or Diſſolution of Bodies any other Agent more proper for that purpoſe than Fire. Fire has been its univerſal Diſſolvent, or almoſt always the Soul of its other Diſſolvents; and we have not otherways been able to Diſcover the nature of Compound Bodies, but only ſo far as we could unravel their Contexture, and unfold their Principles.

It is not that Men had not already bethought themſelves of uſing another Fire, incomparably more active than the Culinary, that is to ſay, the Rays of the Sun reunited by the Burning-Glaſs; but they knew no other excepting thoſe Glaſſes that were Concave, and of Metal, and which burnt by Reflexion; and for as much as it is neceſſary that the Burning-Glaſs, to make the Focus the ſmaller, and conſequently more vigorous, ſhould be exactly parallel with the Disk of the Sun, the Rays which came perpendicularly, that is from Top to Bottom could not be otherwiſe reflected, but perpendicularly again, that is to ſay, from the Bottom to the Top, and the Veſſels into which they put the Solid Matters, in order to melt them, being neceſſarily in a reverſed Situation, thoſe Matters ran out upon the Ground as ſoon as they felt the Sun, ſo that Men could make no followed nor laſting Experiment, and the Burning-Glaſs became thereby a Curioſity almoſt entirely uſeleſs.

It was therefore neceſſary that the Glaſſes ſhould be Convex, and burn by Refraction, becauſe then the Rays would always deſcend perpendicularly, and the Matter in which they were to be uſed would be in a convenient Situation. But for great Focus's, ſuch as thoſe that were wanted, great Glaſſes were required; and beſides the Difficulty of cutting ſuch great ones, ſince one can hardly reach thoſe that are necceſſary for great Teleſcopes, which have but ſome inches of Diameter, there ſtill remains ſtill the Difficulty of melting a ſufficient Quantity of Glaſs without breaking it as it came out of the Oven, or as it cooled.

We have ſeen in the Hiſtories of 1699, and 1700, that Monſieur *Tſchirnhaus*, Aſſociate Academiſt, had found out the Art of making Glaſſes Convex of 3 or 4 Foot in Diameter, which is an extraordinary Thickneſs, and the Effects that it produced are there related.

The Duke of *Orleans* ſent for one of thoſe great Glaſſes of Monſieur *Tſchirnhaus*'s from *Germany*, placed it in the Garden of the Royal Palace, and has had the Goodneſs to allow the uſe of it to the Academy, who can't uſe it with more underſtanding than his Royal Highneſs himſelf.

Monſieur *Homberg*, whoſe Patron that Prince is, has taken the Advantage of uſing that Glaſs as much as he could: But one would ſcarce believe perhaps that during all the Summer of this Year 1702, he could meet with but 8 Days that were entirely favourable, in which the Sun ſhined out clear from 9 or 10 in the Morning, to 3 or 4 in the Afternoon.

He began with the Trial of Metals, and particularly with that of Gold.

Gold, let it be as well refined as poſſible, being put to the Focus crackles and throws out an infinity of very ſmall Drops to the diſtance of 7 or 8 Inches, which being catched upon Paper and beaten, make a Powder of real Gold; ſo that all their alteration conſiſts in the minute Diviſion of them.

Let the Gold be a little farther removed from the exact place of the Focus, and it will preſently ſmoak, and almoſt as ſoon a good part of it be turned into Glaſs, of a deep Violet Colour; and if you pleaſe, all that is not evaporated in Smoak ſhall be vitrified. This Golden Glaſs weighs leſs than the Gold it ſelf.

If you remove it farther from the Focus, it will only ſmoak, and that which is loſt of it will be loſt very ſlowly. It would even fix it ſelf, if care were not taken now and then to bring it nearer to the Focus.

It appears plainly, and at firſt ſight, by theſe Phenomena, that Gold is not fixed, ſince the Heat of the Sun makes it evaporate; and that it is only ſo with reſpect to the more groſs and unactive Fire of the Laboratories. It appears moreover, that by the Sun's Heat it is abſolutely decompoſed, and its firſt Principles ſeparated, ſince one Part of its Subſtance is exhaled in Smoak, and the other, which muſt be very different, is turned into Glaſs. But that you may better underſtand this Effect you ought to be informed exactly of the Nature of Vitrification.

Glaſs is compoſed of a very fine and good Sand, and of the fixed Salts of Plants, which are put together over a great Fire. Theſe Salts being violently agitated by the Heat, and not being able to evaporate by reaſon of their Fixedneſs, penetrate on all ſides the Sand or Earth wherewith they are mingled, dividing and ſub-dividing it after ſuch a manner, that there does not remain, as one may ſay, two Atoms of earthy Matter which has not been ſeparated by one Atom of Salt. From thence proceeds at the ſame time, both the Fragility and the Tranſparency of Glaſs; which in the ſmalleſt Parts of it is compoſed of heterogeneous and diſſimular Particles, which conſequently are not much united together, and the Intervals or Spaces of which always admit Light. All Vitrification therefore reſults from an Earth, which being expoſed to a great Heat, has been intimately penetrated by ſome other Body that melts it.

Now if we ſuppoſe that the Principles of Gold are Mercury, a metallick Sulphur, and an Earth, the whole will be eaſily explained. The Mercury which is volatile, is that which is exhaled in Smoak. There remains the Earth and the Sulphur which are fixed; the Sulphur is that which puts the Earth into Fuſion and vitrifies it. The Glaſs of Gold is leſs heavy than the Gold it ſelf; for that which is moſt weighty in Gold is its Mercury, which does not enter into the Formation of the Glaſs. But how comes it that Mercury, which is the moſt heavy Principle, ſhould be volatile, whilſt the other two, tho' lighter, are fixed? The Reaſon is, becauſe Mercury is not volatile, but on account of the extream Facility with which it is divided into Parts indefinitely ſmall. Thus Water, tho' more heavy than Air, riſes up into it when it is reduced into Vapours.

Other Experiments ſupport this Syſtem. If Silver refined by Lead be expoſed to the Sun, there will be formed upon its Surface a pretty thick Powder, which does not vitrifie; but if you take Silver that has been refined by Antimony, the Powder of that will be vitrified. The reaſon is, becauſe Silver has of it ſelf too little Sulphur in proportion to the Quantity of its Earth; but when it paſſes through the Antimony it retains the Sulphur thereof, which augments the Quantity and Strength of its own.

After theſe Explanations, we ſhall not be ſurprized, if Gold that has been melted in the Sun, and ſuffer'd to fix, be afterwards more difficultly diſſolved by the Spirit of Salt, the common Diſſolvent of this Metal, and if it be diſſolved without any ſenſible Ebullition; we preſently conceive that Gold having been melted in the Sun, and by conſequence infinitely divided into all its little Molecules or Atoms of Gold, theſe Atoms when their Motion ceaſes are united, and more cloſely preſſed together than before, and conſequently have ſmaller Pores, which receive more difficultly the Points of the acid Diſſolvent. At the ſame time, thoſe Pores being ſmaller, contain leſs of the aërial and foreign Matter. Now the Ebullition which is made in the melting of any Metal, does only proceed from ſuch aërial Matter, of which the Springs and the Spires are dilated when its Priſons are open'd.

Monſieur *Homberg* maintains, that our Culinary Fire is nothing elſe but a Mixture of that infinitely ſubtile Matter which makes Light, and of a courſe Oil drawn from Wood or any other Materials that are uſed for Fuel. The Fire of the Sun, is nothing elſe but the pure unmixed Matter of Light, and how great muſt the difference be between the Activity and between the Effects of one and the other, between a Chymiſtry that has as yet made uſe only of the firſt ſort, and that which is aſſiſted by the latter? *We may expect, without being too preſumptuous, a Sett of Phyſicks almoſt New, ſince we have found out a new Key to let our ſelves into the internal Compoſition of Bodies.*

Upon the Perpendicularity of the Bodies of TREES *and* PLANTS, *with reſpect to the Horizon.*

IF it be remembred that the Perpendicularity of the Bodies of Plants, in relation to the Earth from whence they Spring, or, which is the ſame thing, with reſpect to the Horizon, has been counted wonderful in our Hiſtory of 1700, it will be eaſie to joyn the following Obſervation to what Monſ. *Dodart* reported before upon that Subject.

The ſame Gentleman ſaw, in the Month of *December*, a heap of Acorns upon the Ground, which had been trod under the feet of Paſſengers; ſeveral of thoſe Acorns had put out, but none of 'em had taken root. All thoſe *Germes* are nothing but the Roots of the growing Plant, and they ſprang out of the Centre of the pointed part of the Acorn, and were from 4 to 18 or 20 Lines in length. In a word, all theſe *Germes* or little Roots crept along ſeeking the Earth; and as there was none of 'em which by the chance of their Situation were directly turned towards the Ground, they made all of 'em ſuch Turnings and Windings as were neceſſary to get thither by the ſhorteſt way, or perpendicularly.

Monſ. *Dodart* obſerved particularly one Acorn that had the Centre of its Point turned directly upwards or towards the Zenith, and the Root which came out of it, after having followed that Direction for about the length of an Inch, turned ſhort of it ſelf, that it might incline towards the Earth.

This put Monſ. *Dodart* upon the Thoughts of planting ſix of thoſe Acorns in a Flower-Pot, the point of their Root as directly upwards as he could, to ſee what would come of it; and he cover'd 'em with two good Fingers breadth of Earth moderately cruſhed down.

About two Months afterwards he dug them up, and found that all the Roots had made a *Croſs* or *Elbow*, that they might turn downwards; as if they had been ſenſible of the Trick that was put upon them.

According to the Conjecture propoſed by Monſieur *Dodart* in the Hiſtory of 1700, which is, *that the Vapours of the Earth contract the Fibres of the Roots, and thereby draw them towards the Earth*; this Fact would be inexplicable, ſuppoſing that the Acorns had been planted very exactly and geometrically with their Points upwards. For in that caſe the Vapours not being able to affect one ſide, or one part of the Root more than the other, they could not contract the Fibres thereof on any ſide; and conſequently they muſt leave to the Root its firſt Direction upwards. But it is probable, that this Geometrical Exactneſs was not, and even could not be obſerved in planting the Acorns, ſo that as ſoon as the little Root inclined towards the Earth more on the one ſide than on the other, the Vapours preſently found out that weak Part, and there applied themſelves to contract the Fibres, and by that means to draw the whole Root downwards.

Upon the Origin of RIVERS.

MOnſieur *Mariotte*, and Monſieur *Perrault*, a Brother of him who has been one of the moſt Worthy Members of the Academy of Sciences, have referr'd the Origin of *Fountains* and *Rivers* to *Rain.*

Thoſe Gentlemen pretend that the Rains penetrate the Earth 'till they meet with the Clayey Parts of it, which are ſolid enough to ſuſtain and ſtop them, and that they glide and run along the Bottoms of ſuch Earth, on the Sides that are moſt inclined or ſteepeſt, 'till they meet with an Opening, by which they eſcape; that is what we call a *Spring.* If we calculate the quantity of *Rain* or *Snow* that falls in a Year upon all that Earth which is to furniſh, for inſtance, the Water of the *Seine*, we ſhall find that the *Seine* does not require above the 6th part thereof, which allows the Authors of this Syſtem room enough. As for the Continuity of the running of Rivers, it proceeds from the ſlow manner in which the Rains penetrate the Earth, which are a long time in gathering themſelves upon the Bottoms that contain them after they are fallen. Moreover, when the Rivers are very large and deep, they overflow the Lands a great way beyond their Banks, with the Waters which re-deſcend afterwards into thoſe ſame Rivers, as they become lower; but their Deſcent is ſlow, and conſequently contributes towards feeding them in ſpight of the long Drougths. The Birth of theſe Springs is ordinarily at the foot of Mountains, becauſe the Mountains collect the largeſt Quantities of Water, and give 'em a greater Inclination towards one and the ſame Side; and if we ſometimes meet with Springs in high places, and even at the tops of Mountains, they muſt needs deſcend from places that are yet higher, and be carried along Beds of Clay, as if it were by natural Channels. But if between one Mountain, from the top of which there comes a Spring, and a Mountain yet higher, which is to ſupply the Water of it, there ſhould be a little Valley; you muſt imagine that Spring to be like a Water, which from a Receptacle of a certain Depth, has been carried by Subterraneous Pipes, and is come to make a Jet or Caſcade of a Heighth equal to that of the Receptacle, or leſs.

Monſieur *de la Hire* examined this Syſtem at the moſt eſſential Part, where Authors likewiſe ſeem to be leaſt upon their Guard. He had a Mind to try by Experiments, whether the Waters of Rain or Snow could penetrate into the Earth as far as the *Tuff*, or as far as the Clayey parts, and he found they did not penetrate at the depth of 16 Inches in a ſufficient Quantity to form the leaſt Collection of Water upon a ſolid Bottom; beſides, it was neceſſary that the Earth upon which he made his Experiment ſhould be entirely diveſted of Graſs and Plants; for where there was any, and they become a little ſtrong, the Rain was ſo far from being ſufficient to collect it ſelf below the Depth of 16 Inches, that it did not ſuffice even for the Nouriſhment of ſuch Graſs or Plants, and they were forced to water them beſides from time to time.

This Obſervation excited Monſ. *de la Hire* to examine more nicely into the quantity of Water conſumed by Plants. In the Month of *June*, he put into a little Viol, in which there was one Pound of Water exactly weighed, two Leaves of a Fig-tree of a middling Size, and which weighed together five Drachms and 48 Grains; the Stalks of the Leaves were within the Water, and the Neck of the Bottle was very well ſtopped. He expoſed the whole to the Sun and Wind, and in the ſpace of five Hours and a half, the Water in the Viol was diminiſh'd two Drachms, that is to ſay, one 64*th* part, which the two Leaves had drawn, and the Sun and the Air afterwards cauſed to evaporate. As the freſhneſs of the Leaves is not maintained, at leaſt in the day-time and during the Heat, but by the continual Paſſage which they give the Water that aſcends from the Roots, and is afterwards diſſipated, thoſe two Leaves if they had been growing on the Tree, muſt have drawn from the Earth in five Hours and a half, the two Drachms of Water to preſerve themſelves in the ſame ſtate of freſhneſs. One may judge from thence how much the whole Fig-tree drew in one Day; and conſequently, what a prodigious Quantity of Water is ſpent in the Nouriſhment of Plants, it is probably for this reaſon that the Rains do moſt abound in Summer; and that the three Months of *June*, *July* and *Auguſt*, do commonly furniſh as much thereof as all the reſt of the Year. It appears by the Experiment of Monſ. *de la Hire*, that the Rains alone, even in that Seaſon, would not ſuffice for the ſupport of the Plants: for the Moiſture of the Earth, the Dews, Miſts and Fogs, do very much contribute thereto, how then could the Rains only produce Rivers?

The Obſervation of Monſ. *de la Hire* upon the Depth to which Rain-water can penetrate, was made upon a middling ſort of Earth, between Sand and Clay; and which conſequently did not much reſiſt the Water: If the Earth were only Sandy, it is certain the Water would penetrate much deeper, and then, provided that all the other Circumſtances were favourable, a River or a Fountain might proceed from the Rains, and without doubt it does ſo happen in ſome places; but this Origin is not the moſt general.

For Example, How can this agree with the Water of *Rungis* near *Paris?* There is 50 Inches of Water always running; all the Earth that could furniſh it, does not receive a Quantity of Water equal to thoſe 50 Inches, if you compute it according to their continual running; and beſides, the greateſt part of the Rain-waters do either evaporate after they are fallen, or feed the Plants, in a Country that is much cultivated. It is true, the Water there is ſhallow enough, but its Depth does conſiderably exceed 16 Inches. The Country is high, and ſuch is its Diſpoſition, that to bring the Waters from ſome places yet higher, one muſt ſuppoſe that there are natural Pipes, ſuch as thoſe that are made uſe of to throw Water artificially, and that they do deſcend and aſcend after the ſame manner; an Hypotheſis pretty hard to be conceived; for beſides that, this Diſpoſition of the Pipes and Aqueducts is too exact and regular to be natural, how happens it that it ſhould never fail by any Cleft or Crevace?

Wherefore, for the Explanation of theſe Kinds of Springs, other Philoſophers have fancied Subterraneous and Concave Rocks, which like Alembicks receiving from the bottom of the Earth watry Vapours, might condenſe them by their Coldneſs, and reduce them to Water again. But Monſ. *de la Hire* obſerves, that this Syſtem can't be applied to the Waters of *Rungis*; for he cauſed ſeveral Pits to be made thereabouts, but could find no Rocks; and conſequently thoſe Waters were not collected by ſuch ſubterraneous Alembicks.

What remains then? Monſ. *de la Hire* inclines moſt to this laſt Syſtem, but allows not of the Neceſſity of Alembicks. There may be under Ground, and upon a Level with the Sea, great Receptacles of Water, from whence the Heat of the bottom of the Earth will raiſe Vapours, which being come towards the Surface, will be condenſed by the Cold they meet there; after which they will run upon the firſt Bed of Clay they can find, 'till an opening throws them out of the Boſom of the Earth. But theſe Vapours when they have reſumed their firſt Nature of Water, can't fall down again by the ſame Conduits by which they aſcended when they were Vapours; and tho' that could be conceived, yet it is nevertheleſs a

Difficulty, and a kind of begging the Queſtion in this Syſtem.

Monſieur *de la Hire* has, notwithſtanding, improved the ſame by a new Notion: He ſuppoſes that the Salts in Stones may ſtop and fix the Vapours, and thereby contribute to the changing them into Water again; and we ſhall ſee that an Experiment, which he has not carried ſo far as he intended, favours that Notion.

The Fountains of freſh Water which ſeem to have a Flux and Reflux like the Sea, and which nevertheleſs do not come from it, becauſe their Waters are freſh, do naturally enter into the Hypotheſis of Monſ. *de la Hire*. When the Sea aſcends, it compreſſes the Air incloſed in the Cavities that contain the Subterraneous Waters, and the Air thus compreſſed obliges them to fly out by ſome Orifices, which we ſee commonly perform'd by ſeveral Machines. As for thoſe Fountains, which only flow by Intervals, and at certain Hours of the Day, they proceed from ſome Snows upon which the Sun does not ſhine at thoſe Times, and which ceaſe melting when that is withdrawn.

By theſe two Examples it will be eaſy to ſolve the Cauſes of extraordinary Fountains, as ſoon as we can be informed of the particular Circumſtances of them; the greateſt Difficulty is to come at good Accounts, and ſuch as are throughly purged from thoſe falſe Miracles which popular Traditions are always adding.

From this general Theory Monſieur *de la Hire* deſcends to particular Remarks upon the uſe of Rain and Spring-water, and that contained in Ciſterns. He takes notice of an Accident new enough, of ſome Rain-water kept in the Obſervatory, and which ſmelled very much of the Smoak, the reaſon of which was, the Obſervatory ſtands on the South-ſide of *Paris*, and that Rain fell with a North Wind, which drove the Smoak of the Chimneys upon the Obſervatory, and mingled the Particles thereof with the Rain.

* * *

Upon the Manner in which ſeveral BODIES *are turned.*

IT is not only our Underſtanding that is at a Fault in diſcovering natural Cauſes, but it ſeems likewiſe that our very Eyes are deficient in obſerving the Effects, and a thouſand things do continually offer themſelves to our View, without being taken notice of.

How few are they that know that the *Shells* of *Snails*, which are *Helixes* turned about a ſort of a Cone, are all turned after the ſame manner in the ſame Kind, and, which is yet more conſiderable, after the ſame manner, in almoſt all the Kinds? The manner of turning is from the Left to the Right, if you view the Shells from the ſharp end upwards. Monſieur *Parent*, after ſeveral Enquiries into all the Snails of the Land, of the River, of the Sea, and even of the Stones, could meet with but three Kinds in which the Shells are turned from the Right to the Left.

He has carried this Obſervation as far as the Plants, of which there are a great number that have either their Stalks, or their Flowers, or their Cods, turned after a certain manner; others, whoſe Flowers or Seeds run along about the Body of the Plant like a Helix, and conſequently faſten themſelves thereto in a determinate manner, which manner is always the ſame in the ſame kind; and moreover Monſieur *Parent* having made the moſt ample Reckoning he was able of the different Kinds with reſpect to theſe ſorts of Peculiarities, he always found that one certain manner was predominant, that is to ſay, for inſtance, that in 33 kinds of Plants that had their Stalks turned to the Right, there were but four turned otherwiſe; and that in 15 kinds the Cods or ſhells were turned to the Left, and in two only to the Right.

Monſieur *Parent* has likewiſe obſerved, that the Fibres of a Heart of a Man, are always turned in the ſame manner, the External from the Right to the Left deſcending, and the Internal after the ſame manner aſcending; and that on the contrary, the *Tuff*, which the growing Hairs form on the Top of the Head, is almoſt always turned from the Left to the Right with reſpect to him that wears them.

It is ſufficient to have ſaid, that upon theſe kinds of Subjects that are ſo rarely taken notice of, Obſervations may be made, and that one may turn ones Eyes and Thoughts that way. Every Body will afterwards find enow of the like Occaſions in contemplating Nature.

The conſtant and invariable Determination of ſome Parts, whether it be of a Plant, or whether it be of an Animal, to be turned after one and the ſame manner, does aſſuredly proceed from the Grain or the Egg, and this is a new Proof that Generation is nothing but an Unfolding: *But who has fixed this Determination in the Egg, or in the Seed?*

The ſame Queſtion might be ſtarted upon the ſame manner in which Planets turn, and all may be referr'd to the firſt and purely arbitrary Will of Him that made the World. But another Queſtion, to which one ſeems obliged to anſwer, by the Concatenation of ſecond Cauſes, is to know, why a greater Number, either of Plants or Shells, are turned after one certain manner?

Monſieur *Parent* conjectures, that this may have ſome Affinity with the Syſtem of the Loadſtone. He believes that we may allow of two Vortexes, or Whirlpools, of magnetick Matter turning in the Figure of a *Helix* about the Earth, and the length of its Axis, in two ways oppoſite to each other, one of which comes out of one Hemiſphere, and the other at the oppoſite Hemiſphere. This magnetick Matter is ſubtile enough to penetrate Bodies, and conſequently Eggs or Seeds; and if by any Cauſe whatever, one of the Vortexes have more Facility than the other, to penetrate certain Seeds or Eggs, it turns them in the manner peculiar to it ſelf. Perhaps each Vortex has generally more influence in the Hemiſphere out of which it comes. At this rate the Bodies capable of being turn'd would affect a different manner in the Southern Hemiſphere from that in ours; but it is eaſie to judge how many Obſervations are neceſſary to make good this Fancy: It is ſufficient to propoſe it at preſent, and to ſhew ſome kind of Probability in it.

An Extract of a Letter from Monſieur SARRASIN, *the French King's Phyſician in* Canada, *concerning the* Caſtor *or* Beaver; *communicated to the Academy by Monſ.* TOURNEFORT.

THE largeſt *Beavers* are 3 or 4 Foot in Length, and from 12 to 15 Inches in Breadth in the middle of their Breaſt, and from one Hip to the other; they commonly weigh from 40 to 60 Pounds: As to the Length of their Lives, it is thought it does not exceed 15 or 20 Years. Theſe Animals are uſually very Black in the moſt Northen Countries: We meet likewiſe with ſome that are White; thoſe of *Canada* are for the moſt part Brown, but that Colour grows lighter in proportion, as the Countries in which thy are found are more temperate; for they are Yellow, and even very near the Colour of Straw in the Country of the *Ilinois* and the *Chaouanos*.

The *Beaver*, of which I give an account here, was pretty Black, tho' taken on the ſide of a little Lake, about 12 or 15 Leagues from *Quebec*, it weighed above 50 Pounds.

This Animal is covered throughout with two ſorts of Hair, excepting his Feet, where the Hair is all the ſame and very ſhort. The Hair of the firſt kind is of the Length of, from 8 or 10 Lines, to 2 Inches, and grows ſhorter towards the Head and Tail; this is the Biggeſt, Coarſeſt, and moſt Shining, and gives the chief Colour to the *Beaver*: If you view one of theſe Hairs with a

Microſcope, you ſee in the middle of it a Line much more tranſparent than the Sides, which makes me think it is hollow.

The other kind of Hair is a very fine and cloſe Down, of the Length of about an Inch; it defends the Creature from Cold, and ſerves to make Hatts and Stuffs: The Skins that have been uſed by the *Indians* for Cloaths or Coverings for their Beds are the moſt ſought after, by reaſon that they have loſt their long Hair, and that the Down which remains is become fat and oily by the Effluviums that come out of their Bodies, and ſo are much the better for the uſe of the Workman. When the Animal is alive and at work, this Down is preſerved and defended from the Dirt by the coarſe and long Hair.

There are ſeveral Particulars relating to the manner of Life of this Creature that are worthy Obſervation.

1. When the Innundations and Floods are paſt, the Females return to their Lodgings to bring forth their Young; the Males keep the Field 'till the Months of *June* and *July*, and don't return home 'till the Waters are quite down; then they repair the Damage which the Floods have done to their Houſes, or elſe they make new ones. They change the Place of their Habitation for three principal Reaſons. (1.) When they have conſumed the Food that was neareſt them. (2.) When they are too many of 'em together. And, (3.) when the Hunters are too troubleſome to them.

2. When they are about eſtabliſhing their Dwellings, they make choice of a place plentiful in Proviſion, water'd with a little River, and proper for making a Lake or Dam; they begin with raiſing

a Cauſey of a ſufficient Heighth, to bring the Water up to the firſt Story of their Houſes. If the Country is flat, and the River *hollow*, the Cauſeys are long, but not ſo high as in the Valleys. Theſe Cauſeys are 10 or 12 Foot thick at their Foundation, but grow ſtill narrower to the Top, where they don't commonly exceed 2 Foot. As theſe Animals have a great Facility in cutting Wood, they do not ſpare it, and they commonly cut it in pieces as big as ones Arm or Leg, and of the Length of from 2 to 4, 5 or 6 Feet; they thruſt them by one of the Ends very deep into the Earth, and place them very near one another, croſſing them with other pieces of Wood, but ſmaller and ſlenderer, filling the hollow Places with Clay, they continue in proportion as the Water riſes, that ſo they may more eaſily tranſport the Materials. They ſtop at laſt theſe ſorts of Dykes when the Waters incloſed can reach the firſt Floor of the Houſe they are making; the ſide of the Cauſey next the Water is made ſloaping, and the Water that weighs according to its Depth, preſſes it powerfully againſt the Earth, the oppoſite ſide is perpendicular; they are ſolid enough to ſuſtain the Perſons that walk upon them, and theſe Animals are very careful to keep them in good Repair, patching up the leaſt Breach or Gap with Clay; if they find that they are obſerved by the Hunters, they either work by Night or elſe quite forſake their Buildings.

3. The Cauſey being finiſhed, they work at their Cabins or Houſes, of which they always lay a ſolid Foundation on the Banks of the Water, upon ſome little Iſle, or elſe upon Piles. Their Houſes are round or oval, and ſtand two third Parts out

of the Water, but they take great care to leave one Door that cannot be ſtopt by the Ice. Sometimes they build their whole Cabin upon the Earth, and make Ditches of 5 or 6 Feet in depth, which they bring quite to the Water; they uſe the ſame Materials for their Houſes as for the Cauſeys, except, that the Houſes are perpendicular, and end in a kind of Dome; the Walls are commonly two Foot in thickneſs; their Teeth being as good as the beſt Saws; they cut all the ends of the Wood that ſtand out of the Walls, and cover the inſide and the out with a kind of *Plaiſtering* made with Clay and dry Herbs; upon this occaſion they make uſe of their Tails to ſmooth and ſettle this Plaiſtering.

4. The inſide of the Cabin is vaulted in the Figure of a handle of a Basket, and made fit to lodge 8 or 10 Beavers. Out of work this Houſe has 8 or 10 Foot in Breadth, by 10 or 12 in Length, ſuppoſing the Cabin to be Oval. In work it is 4 or 5 Foot broad, and 5 or 6 long: If the number of Beavers is 15 or 20, and ſometimes to 30, which however is very rare, the Houſe is large in proportion, and there are even ſeveral of 'em oppoſite to one another. Some Miſſionaries have aſſured me that they have found 400 Beavers lodg'd in different Cabins, which maintained a Communication with each other. There are ſeveral Stories in a Houſe, to the end that the Creatures may retire as the Waters increaſe upon them; they have likewiſe a Hole or Opening diſtinct from their Door, and from the Place where they waſh themſelves; the uſe of thoſe Holes is for diſcharging their Excrements.

5. There are of theſe Creatures that they call Land-Beavers, and theſe are lodged in Caverns made in a Ground higher than the Banks of the Water. They begin their Houſe by an Opening that is more or leſs advanced into the Water, according as the Ice may be more or leſs thick, and they continue this opening 5 or 6 Foot in length, but it has no more breadth than juſt enough for a Paſſage; after which they make a little Dam of 3 or 4 foot every way, where they bath as often as they pleaſe. Afterwards they cut another Trench or Cavity in the Earth, which riſes likewiſe by Stories, to keep themſelves dry as the Waters ſwell. We meet with ſome of theſe that are above 100 foot in length; the Beavers cover the places where they lie with Graſs; in Winter they make Shavings, which ſerve them inſtead of Mats.

6. All theſe Works, eſpecially of thoſe Beavers that live in the Cold Countries, are commonly finiſhed in the Months of *Auguſt* and *September*, which is the time when they begin to make their Winter Proviſions: They therefore cut Wood into long pieces, from 2 or 3 foot, to 8 or 10; the great pieces are drawn by ſeveral of theſe Animals, the little by one only, but by ſeveral ways, leaſt they ſhould interfere with each other. At firſt they put a certain quantity of the Wood upon the Water, where it floats; then they place new pieces upon the former, ſo heaping on more and more, till their Proviſion anſwers to the number of Animals that intend to lodge together: For inſtance, the Proviſion for 8 or 10 Beavers is 25 or 30 foot ſquare, upon 8 or 10 foot in depth; this Wood is not heapt up after the manner of our Stacks, but

in ſuch a way that they can take it down when they pleaſe, and they only eat ſuch pieces as are ſoak'd in the Water; but before they eat 'em, they cut them very ſmall, and carry them into that part of the Cabin where they lye; if they had cut them down before they had put them into their Wood-yard, the Water would diſperſe and carry them away.

7. As to the Hunting of thoſe Creatures, it is made from the beginning of *Nov.* to the Month of *March* and *April*, becauſe they are well ſtockt with Hair. They either kill them by Ambuſcades, or they take them with Snares, or by digging Pits for them; the Ambuſcade is the moſt troubleſome and leaſt certain way; the moſt uſual is that of laying Snares for them. Tho' the Beavers have laid in their Proviſions, they go nevertheleſs into the Woods from time to time, to ſeek for freſh Food; the Hunters alſo that know how much they love freſh Wood, above that which has been floating in the Water, bring them ſome and lay it near their Cabins, at the ſame time making ſuch Traps as are uſed for catching Rats; they plant deep in the Ground ſeveral Sticks of 3 or 4 Foot in length, among which there is one laid a-croſs very heavy, raiſed about a foot and a half, under which they put for a Bait, a Branch of Popler Tree, of the length of 5 or 6 Foot, which leads to another very ſmall Branch; this anſwers to the croſs one with ſo much exactneſs, that tho' the Beaver moves the firſt, *the Croſs beam* does not fall, till he cuts the little Branch, and then it always coſts him his Life.

8. The way of taking the Beavers by Pits is thus; they make Holes in the Ice with proper Inſtruments when it is not above a Foot thick;

the Beavers don't fail to come to theſe Holes for Breath, and then they kill 'em with a Hatchet. There are Hunters that fill theſe Holes with the the Beards of Corn, or with Straw, that they may not be ſeen by the Beavers, and then they catch 'em by one of their hinder Feet. If there is any Brook near their Cabins, they cut the Ice a-croſs, and place a good ſtrong Net over it, in the mean time another breaks the Cabin to drive out the Beavers, which don't fail to make towards the Hole in the Ice, and ſo fall into the Snare.

A Philoſophical Account of the FORMICA-LEO, *or* LION-ANT, *by Monſieur* POUPART.

THE *Formica-leo* or *Lion-ant*, is an Inſect that pretty much reſembles a Spider by its Inclinations, by its Manner of Spinning, and by the Figure and Softneſs of its Body. It has ſomething likewiſe of the *Hog-louſe*, and at firſt ſight one would take it for that little Animal. Its Colour is a dark Grey, it is marked with black Points, like ſo many little Spears, which make it appear all armed with Quills like a Porcupine, when one looks upon it thro' a Microſcope: Its Body is ſurrounded with ſeveral Circles, which makes it appear all wrinkled: It hath ſix Feet, four are faſten'd to its Breaſt, and two to a long thing that one would take for its Neck; Its Head is little and flat, its two Horns hard, hollow, of the length of two Lines, a little bigger than a ſingle Hair, and crooked at the end like the Nails of a Cat. When one views them with the Microſcope they look like the Horns of a great Beetle, which we call a Flying-ſtag: At the Baſis or Bottom of each of thoſe Horns, there is a little black Eye which ſees very quick, for the Inſect runs away at the ſmalleſt Object it perceives.

This Inſect is called the *Formica-leo*, becauſe it uſually lives upon *Ants* that fall into its Snares: but that ſhould not entitle him to the Name of a *Lion*, being nothing more than the Cunning of a *Fox*; it would therefore more properly be named the *Formica-vulpes*.

Temperance is of great uſe to this little Animal, for it lives upon nothing elſe but ſome Ants or other Inſects, that accidentally fall into its Trap; but the greateſt part of his Prey are the Ants, becauſe all the little Animals that have Wings eſcape his Ambuſhes; and others are either too big, or their Skin too hard to be pierced by its Horns.

This is his Method for catching Inſects, he commonly plants himſelf at the foot of an old Wall, to be cover'd againſt the Rain. There muſt be a very fine and dry Sand in the place, to the end that he may make a Pit or Hole, the Figure of which is a Concave Cone inverted.

When he has a mind to make but a ſmall Hole, he bends his Tail downwards, which ends in a Point, and which he uſes like a kind of a Plowſhare, with which he tills the Ground, marching backwards, and with little ſhakings: When he is come to a ſmall Depth, he toſſes the Sand very high with his Head, ſeveral times, and as faſt as he can; and ſo his Pit is made.

But when he would make a deep Ditch, he draws at firſt a great Circle which is the Baſis of the Cone or Pit, that he is about to dig. He then thruſts himſelf under the Sand, which he toſſes up very high with his Head at every Step he makes, always going backwards. As he deſcends he deſcribes a Spiral Line, which ends inwards at the point of the Concave Cone that he has formed.

His Head is very proper for throwing the Sand, for it is flat, and his Neck very long when he does not draw it in: Thus he is able to give great toſſes, as I have ſeen in thoſe that I have obſerved, which have ſometimes thrown half a Foot from their Dens the Carcaſſes of the little Inſects they have ſucked. When the Sand-Den or Pit is finiſhed, he places himſelf on the ſide of the Bottom of it, and nothing appears of him but his two Horns, which he opens at the top of the Pit.

Whilſt he lies thus in Ambuſcade, if any Ant, or other like Inſect, paſſes by upon the brink of his Pit, and throws down any Grains of Sand as it goes along, that is a Warning to the *Formica-leo*, that there is Game for him at hand, with that he toſſes up ſome Sand with his Head upon the Ant, to make it fall into the bottom of his Den between his two Horns, for he never runs after it. But as that does not always come to paſs at the firſt ſtroke, and the Inſect diſcovers the Snares that are laid for it, it climbs up to get out of the Hole, and ſometimes falls back, by reaſon of the mobility or looſneſs of the Sand; then it trys to get up again, but the *Formica-leo*, always upon the watch throws more Sand upon it; if the little Creature falls into his Horns, he cloſes it in them, and contracts them nearer to his Body, croſſing them over one another, then draws the Inſect under the Sand, ſucking it as long as he finds any Moiſture in it.

When there remains nothing more than the Skin of the Ant, he toſſes it out of his Den, and if that happen to be demoliſhed, or diſorder'd in the Scuffle, he repairs it for freſh Game.

This Animal would rather die of Hunger than go out to ſeek for his Food, as other Inſects do; but it is not thro' Cowardice, as one would be apt to think, that he makes this crafty ſort of War; for he cannot do otherwiſe, becauſe he never goes but Crab-like, backwards and by little Leaps. He is Day and Night upon the watch hid under the Sand in the bottom of his Den; becauſe not being able to hunt for his Prey, he muſt be content with what Chance brings him, which does not often happen: Thus he is forced to do in length of Time, what Nature will not ſuffer him to do by Motion or Swiftneſs.

But it ſhould ſeem, for the Reaſons which I am going to alledge, that all theſe Devices are uſeleſs for the Subſiſtence of this little Animal, which one would ſay does only catch Inſects out of Pleaſure, and to divert it ſelf like a good Sportſman.

1. He never cloſes the Inſects but with the extremity of his Horns, which do not ſeem to be hollow at the end of 'em; wherefore it is not very likely that he ſhould draw out the Blood of the little Inſects with that part.

2. When one views this Creature with a Microſcope, one can't perceive that he puts out any Sting or Inſtrument proper to ſuck thoſe Inſects he

catches, as ſeveral other Creatures do, and one always ſees a conſiderable ſpace between his Head and the Inſect that he embraces with the tips of his Horns.

3. I have put ſeveral of theſe Creatures in a Box, and kept them cloſely ſhut up in it for ſix Months together, leſt any Inſect ſhould fall into their Holes; notwithſtanding which they lived like thoſe that one feeds with Flies, and have made their Snares, and the Changes that I ſhall mention hereafter; which might induce one to believe that the *Formica-leo* can live without Food.

But when one conſiders that his Horns grow after they have been cut off; that he falls away when he can get no Food; that after having caught but one Inſect only he ſeems much bigger than he was before, and that having ſuck'd a Fly for the ſpace of two or three Hours, that Fly becomes ſo dry, that you may Powder it, by rubbing it between your Fingers; I ſay all this being conſider'd, one muſt be convinced that tho' the *Formica-leo* can live in ſuch a manner, that one does not perceive from whence he fetches his Food, yet he certainly does not ſubſiſt without it.

I believe therefore one may look upon the Horns of the *Formica-leo*, as two Syringes with which he pumps out the Juice of the Inſect. In effect I have conſider'd them with a Microſcope uſed for the viewing Liquors, and which extreamly magnifies the Objects, and I perceived a tranſparent and membranous Body that ran along the Cavity of the Horn, the Uſe of which might be the ſame with the Sucker in the Syringe.

When the *Formica-leo* is arrived at a certain Age, and would renew himſelf that he may appear under another Shape, then he makes no more Snares, but ploughs the Sand, leaving Tracts and very irregular Roads upon it.

After he has been a long time ploughing, he buries himſelf under the Sand, where he makes a hollow Globe, or Bowl, wherein he ſhuts himſelf up, in order to his Transformation. This Bowl is made of Silk, Glue and Sand, all mixt together, he ſpins his Silk with his Back-parts almoſt like a Spider. The Glue comes out of all Parts of his Body, and for Sand he has enough in the Place of his Retreat.

To make this Bowl, he turns inſenſibly into an Orb as upon a Centre, throwing his Back-part every way till he touches the Sand with it, in order to faſten the Silk thereto; which faſtening is performed either by entangling the Silk in the rough Parts of the Grains of Sand, or elſe with a viſcous Matter, with which perhaps the Silk it ſelf may be impregnated. But let it happen how it will, the Grains of Sand are ſo well glued to the Silk, that it is pretty hard to ſeparate them from it, even tho' you ſhake 'em ſtrongly whilſt the Work is yet ſoft, or rub them with the Fingers.

This Silk is incomparably finer than the ordinary Silk, for you can ſcarce ſee it but with the help of a Microſcope; to view it well you muſt dig out the work of theſe little Creatures, before it be quite finiſhed; you will then find it ſoft like Cotton, not having been yet harden'd by the Glue which proceeds but very ſlowly from the Body of the Animal: You muſt raiſe this Silk into the Air with the Point of a Needle, and you will ſee Spaces between the Grains of Sand as they hang down, without being able to ſee the Silk it ſelf, ſo exceeding fine is it, unleſs you uſe a Microſcope.

It is impoſſible without ſome Art to ſee how theſe Animals ſpin their Silk, and how they build their Houſes, becauſe they always work under the Sand. You muſt therefore take away the Work from them ſeveral times before it is finiſhed, and then they will begin it again, and at laſt become ſo weak with working, that they will no longer have Strength enough to hide themſelves under the Sand, according to their Cuſtom, by which means you ſhall ſee them ſlowly ſpinning their Silk with their back Parts upon the Superficies of the Sand, after the manner that I have already related.

When the *Formica-leo* has wrought a long time, he finds himſelf in the middle of a great ſoft Ball, which as yet is only compoſed of Silk and Sand mixed together: This Ball grows harder by little and little, being moiſten'd with a viſcous Matter that comes out of the Body of the Animal, and penetrates his Houſe on all Sides.

That which chiefly convinced me that there proceeded a glutinous Humour out of the Bodies of theſe little Animals, was the ſeeing ſeveral Grains of Sand faſten'd to the Neck of one of 'em, where it made a little hard Rock; whilſt he had this Burden upon his Neck, he could make no more Snares, becauſe it hinder'd him from moving his Head; whereupon I broke the little Rock off, and then the *Formica-leo* preſently made his Snare, and ſometime after ſet about making his little Houſe.

When the *Formica-leo* is ſhut up in his little Habitation, he lines it on the inſide with the Silk which he Spins. This Silk being no longer mingled with Sand, is formed into a very cloſe Texture, and reſembles a little Pearl-colour'd Satin in which the Animal takes its reſt, having his Head folded between his Legs. One might imagine at firſt, that this Sattin is a dry Glue looſen'd from the Body of the Animal; but if that were ſo, it would eaſily break in the folding or bending of it, which does not happen, nor would it be ſo flexible as it is: Beſides, this little Stuff makes part of his Caſe, at leaſt it is ſo well faſten'd to it, that it can't be ſeparated without deſtroying the Caſe it ſelf. I put this Sattin into the Water for ſome Days, but it did not diſſolve, as it ſhould have done if it had been a Glue; however it loſt its fine Colour, which made me think that the little Glue that was mixed with the Silk, and which perhaps gave it that fine Gloſs, was diſſolved, and the Stuff left alone. This little Sattin is pretty like that which is made by certain Spiders upon the Leaves of Trees, ſerving them for a Lodging or Neſt to lay their Eggs; but it is thicker than that of thoſe Spiders.

To ſhew that the *Formica-leo* does not work upon this Tapiſtry, nor hang his little Houſe with it, till it be quite built, if you open it before it be grown hard, you will not find it hung with the Sattin we have been ſpeaking of.

My *Formica-leo*'s remained in their Lodgings for the ſpace of ſix Weeks or two Months before they were turned into little Worms; but the time of their ſtay is not fixed: They had put their Heads between their Legs, to make themſelves as round as poſſible, to the end that they might take up the leſs place, and accommodate themſelves the better to the Concave Figure of their little Bowls.

When the time of their Metamorphoſis came, they began to ſtrip themſelves of their firſt Skin, to which their Horns, their Eyes, and their Hair remained faſten'd. That Skin was whitiſh withinſide, with an opening all the length of the Belly, out of which the Inſect, which I am about to deſcribe, proceeded.

After that the *Formica-leo* has ſhed his Skin, he appears under the Form of a little Worm, which is about three Lines in Length, having four membranous Wings, ſix Feet, two great *Antennæ* or Horns, ſoft and hollow, two black Eyes, and two Pinchers in the form of Saws, which ſerve him for Teeth. This little Worm remains ſometimes in this Condition before it appears under a new Form, but one cannot tell how long, becauſe the *Formica-leo* from which it proceeds, ſhuts himſelf up in his Houſe when he is to be turned into a Worm.

When the Worm would come out of its little Houſe to be metamorphoſed, it gnaws a little round Hole therein with its Teeth, which are prety like thoſe of a Graſhopper: However, the Hole that he makes does not appear round, becauſe the piece commonly remains faſten'd at one end, which renders the Paſſage ſo ſtrait, that half the Worm remains in the Caſe, and t'other half out.

In this Condition the little Worm is no longer living, 'tis only a membranous and traſparent Caſe, with Horns, Eyes, Teeth, Wings, Feet, *&c.* which are the Caſe of the like Parts of a fine Fly that we call a *Demoiſelle*, that comes out of the ſame Tuy or Caſe, by a little Hole made upon the Back near the Head. This Fly is 15 or 16 Lines in Length, but his Wings at firſt are no more but 2; becauſe having been ſhut up in Caſes that were no longer, they were forced to take the Figure and Size thereof. Theſe Wings are moiſt and pleated in ſeveral Folds, which are open'd in two Minutes time, and become longer than the Body.

When the Fly comes out of its Caſe, it remains ſometime upon its Feet to dry its Wings, that it may fly, and enjoy a more merry Life than that which it paſſed under the Skin of the poor *Formica-leo.*

Whilſt this Fly is in the Caſe of the Worm it can have but 3 Lines in Length, becauſe the Worm it ſelf is no longer; but ſo ſoon as it gets out it ſtretches it ſelf as far as 15 Lines. This ſudden unfolding proceeds from hence; whilſt the Fly is ſtill in its Caſe, it is ſhorten'd and folded as a *Courcaillet* which one ſqueezes at both Ends: But as ſoon as it comes out of that Skin, it ſtretches it ſelf to its whole Length, like a Spunge preſſed between the Fingers, which reſumes its natural Bigneſs as ſoon as you ceaſe to preſs it.

In the Year 1703, the *Formica-leo's* that I had obſerved, did not turn into Flyes; that Metamorphoſis not happening till the Year after: This makes me think that theſe little Inſects are not changed in the firſt Year of their Life, and that it is neceſſary for them to arrive at a certain Age before their Transformation.

After that the Fly is come out, if you open the little Houſe, in which the *Formica-leo* was ſhut up, you will find, as we ſaid before, that it is hung with a ſmall Sattin very ſleek, and of the colour of Pearl: You will likewiſe find there the Skin of the *Formica-leo*, which is flatted and ſtuck with Hairs, as have been before obſerved; you may alſo ſee the Membranous Caſe, in which the Fly was immediately incloſed. But that which is particular in it is, that you will ſometimes find an Egg there, which the Fly had laid before ſhe came out: This Egg is two Lines in Length, and one in Thickneſs, and is ſomething like a little *Gland* lengthened out. Its Shell is hard, and altogether like that of a Hen's Egg: The Subſtance contained in it is not Fluid, and I obſerved that the Egg changed its Colour at different Times: I expoſed one of theſe Eggs to the greateſt heat of the Sun for the ſpace of ſeveral Days, and the Matter that was incloſed in it became hard and as black as Ink.

It ſeems as if theſe little Flyes did lay but one Egg, for we could find no more in the Bodies of ſome of them which we opened; there was only one that another had laid in its Houſe before it came out of it, and one Fly faſtening it ſelf to the Top of the Box in which it had been ſhut up, did likewiſe lay an Egg ſome Hours after. However, it is not likely that each of theſe Flyes ſhould lay but one Egg, becauſe there is always ſome of them that are barren, and others that produce Males; from whence we may eaſily conclude, that by little and little the Species would have entirely failed.

One may ſee by the Precipitation with which theſe Flyes lay their Eggs, that they don't always wait for the Approaches of the Male for laying them: It is perhaps, becauſe of the ſeldomneſs of theſe Coitions, that the *Formica-leo*'s and the little Flyes that proceed from them are pretty ſcarce.

The little Bowls in which the *Formica-leo*'s are ſhut up, are abſolutely neceſſary for the Production of the Flyes; for I broke ſome of them, that I might lay the *Formica-leo* upon the Sand at the time when it was ready to be Metamorphoſed, notwithſtanding which it did not forbear to ſhed its Skin, but the Fly would not come out of the Worm, in which it was ſhut up, tho' it lived a great while afterwards, and made ſeveral Motions and Attempts to get out. One of the chief Uſes of this Bowl is, that by its Means the Fly gets out of the Worm in which it is ſhut up, paſſing with Difficulty thro' the little Hole that the Worm it ſelf makes with its Teeth.

It muſt be obſerved, that the different *Demoiſelles* or little Flyes, that during the Summer time ſwarm upon the Water in the Ditches and about the Hedges, do not all proceed from this little Inſect. Thoſe that come from it have two *Antennæ* or Horns that are ſmalleſt next the Head, and grow bigger towards the upper end: They have two great Eyes on the ſides of the Head, but none at Top like the other kinds of Flyes; their Belly is not ſtreakt all the length of it, as it is in others, and the end of their Tail is cover'd with Hairs: Their Wings are of the Colour of white Aſhes, and little black Spots on them; but not diverſified with any lively Colours. Wherefore it is likely, that thoſe fine Flyes, to which the variety of Colours has given the name of *Demoiſelles*, as well as all their different kinds are of another Extraction.

There are two other fine Sorts of great *Demoiſelles*, the Origin of which is very different from thoſe we have been ſpeaking of; they proceed from two watry Inſects, that do not at all reſemble the *Formica-leo*.

We ſhall ſhew ſome time or other that the Inſects from whence theſe larger kinds of *Demoiſelles* proceed, are really Fiſhes, for we have obſerved their *Gils*, &c.

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A Philoſophical Diſcourſe upon the different Heighths of the RIVER SEINE *at different Times.*

EVery thing is worthy to be obſerved, and the Obſcurity of Phyſicks is not perhaps more owing to the Ignorance of Cauſes than to that of even the Effects themſelves. Monſieur *Amontons* had begun to cauſe the Heighths of the *Seine* at different times to be obſerved by one of his Friends, the Situation of whoſe Houſe furniſhed him with an opportunity of doing it. This Friend of his, who was a nice and able Obſerver, had taken a fixed Point upon the *Maſſif* of the New-bridge, or *Pont-neuf*, upon which the Equeſtrial Statue of *Henry* the *Fourth* is placed. From thence he computed, Day by Day, the Riſings and Fallings of the *Seine*, upon an im-

moveable

moveable Graduation which he had made there, and which he viewed with a Teleſcope. Monſ. *Amontons* having received from him the Journal of theſe Obſervations, from the 14*th* of *Sept.* 1703 to the laſt of *Decemb.* 1704, he reduced them to the following Method.

He divided the whole into Elevations and Deſcents of the Water, noting for inſtance, how many Days the Water had riſen from the beginning of the Obſervations, and how high; then how many Days it had fallen, and how low; after that, how many Days it had begun again to riſe, and ſo on.

By the ſingle Journal of thoſe Obſervations, one might ſee, what Time of the Year the River was higheſt or loweſt, and how much one Year differ'd from another, *&c.* and by this Diviſion of Obſervations into Elevations and Deſcents of the Water, one might ſee likewiſe the number of the Elevations and Deſcents of each Year, their Duration, their Greatneſs, and all their Relations, according to theſe different Ways of conſidering them.

For inſtance, Monſieur *Amontons* found that from the 14*th* of *Sept.* 1703, to the 10*th* of *Feb.* 1704, there had been 8 Elevations, which altogether made 223 Inches, and had laſted 77 Days; that from the 10*th* of *Febr. ditto*, to the 18*th* of *Sept.* following, there had been 8 other Elevations, which amounted to no more than 163 Inches, and had laſted 70 Days; from whence he concluded, that the Rains which contribute to ſwell the *Seine* had been much more precipitated, and ſucceeded one another more cloſely from the Autumnal Equinox in 1703, to that of the Vernal in 1704, than ſince this laſt Equinox to that of the following Autumn, becauſe the

Amount of the firſt Elevations was almoſt double to that of the other, and yet the two Periods of Time were almoſt equal.

As to the different Deſcents of the Water in the ſame time, it was found, that their Greatneſs or Quantity, was more proportionable to their Duration; from whence one may conclude, that the Waters not falling as ſwiftly as they riſe, it is probable that at the time that Rivers ſwell, they drive their Waters over the Grounds, which return afterwards, and ſerve to maintain them.

We do not offer theſe Obſervations, but as a Sketch of the Conſequences which one might draw from a ſufficient number of more exact ones, upon the Heighth of Rivers, in different Times. We hope that thoſe who have the conveniency of making 'em, and who have a Taſt for the Advancement of Natural Philoſophy, may hereby be invited to give themſelves that Trouble.

Upon YELLOW AMBER.

AS the fineſt Sort of the *Yellow Amber* comes from the two *Pruſſia*'s, and that it comes from thence in greater quantities than from any other Country, the Academy is perhaps leſs inſtructed in that Matter than thoſe who have done 'em the Honour to conſult them about it. They will however publiſh all they know concerning it themſelves, and will likewiſe add their Obſervations. They don't intend to take notice of what other Authors have ſaid upon it, being perſwaded that it is not a Collection that is expected from them.

Meſſieurs *Caſſini* and *Miraldi* being gone in the Year 1700 into the Southern Provinces of *France*, to work there upon the Prolongation of the *Meridian* of *Paris*, they found ſome Mines of *Jett*, and a kind of *Yellow Amber*, in a Mountain of *Languedoc*, called *Bugarach*, which is at the diſtance of 27600 Fathoms from the Sea, and is ſeparated from it by divers other Mountains that are very high. Some are of opinion that *Jett* as well as the *Yellow Amber*, is a Species of the *Succinum*. The Inhabitants of *Bugarach* make uſe of the *Yellow Amber* to burn in their Lamps; it reſembles pretty much *Roſin*, and is not ſo hard as that of *Pruſſia*. Near the Mines of *Bugarach* there are ſome Springs of Salt Water, which together form a little River.

There is *Yellow Amber* found in the Clefts of the Rocks in ſome of the moſt barren and naked Parts of the Country of *Provence*.

We are likewiſe aſſured by very credible Accounts, that there is found of it in *Sicily* too, upon the Sea ſide, along the Coaſts of *Agrigento*, *Catanea*, *Leocata*, in the Iſland of *Corſa*, and even at *Bologna* in *Italy*, towards *Ancona*, and in the *Umbria* far from the Sea, and a great way up in the Country.

This being joyned with what the Marquis de *Bonnac* informs us, who himſelf has ſeen *Amber* dug out of the Lands of Monſieur *Grata*, ſeparated from the Sea by great Woods, and high Hills, which *Amber* is exactly like that found on the Sea-ſide, the Queſtion ſeems to be decided, that *Amber* is always produced in the Earth.

Beſides, we meet with little Animals impriſon'd in it, and they are always terreſtrial Animals, ſuch as Flyes, Ants, *&c.*

However, for greater Certainty, it would not be amiſs to enquire whether the Terreſtrial Ambers have all the Characteriſticks and the Goodneſs of that which is found upon the Sea-ſide; for it is not impoſſible, but that the Sea may by its Salt work this matter, and give it the laſt degree of Concoction.

Suppoſing that *Amber* be always produced by the Earth, it remains to know whether it ſhould be accounted a Vegetable or a Mineral?

We have never heard that there are in *Pruſſia* any Trees that diſtil *Amber* like Roſin or Gum, or any other Matter of the ſame kind; and yet it appears much more natural that the Flyes and Ants which we ſee in it ſometimes, and which plainly prove that it has been liquid, ſhould have been involved in a Gum dropping from a Tree, than a Mineral formed in the Bowels of the Earth: To ſolve this Difficulty, we muſt ſuppoſe this *Amber* to have run out of ſome Rocks, like the Oil of *Petroleum*, or at leaſt that that, in which we find the little Inſects, may have been liquid for a while, after it came upon the Surface of the Earth.

Whether *Amber* be allowed to be either a Vegetable, or a Mineral, no body has ever yet affirm'd that he has ſeen it liquid, or even ſoft: Nevertheleſs it muſt have been ſo, and even expoſed to view, at the time when it involved the Animals that are found in it.

The Analyſis, or Reſolution of this mixed Body, made by the Chymiſts belonging to the Academy, does not entirely determine of what kind it is. They have always found a very ſmall quantity of a watry Liquor, which had the Odour of *Amber* rubbed, a great deal of an Acid Volatile Salt, and a great deal of Oil, part of which was clear like Water, part Browniſh, and ſome very Black, according to the Degrees of Fire uſed in the Diſtillation of it. There remained a *Caput Mortuum*, light, ſpungy, black and ſhining, which having been calcined in the naked Fire, evaporates almoſt all in Smoak, and they could draw no fixed Salt from it.

The only difference of the Reſolutions of the ſeveral *Ambers* is, that the moſt tranſparent or whiteſt, yield more Oil and Volatile Salt, and leſs of a *Caput Mortuum*, than thoſe that were of a more dark or blackiſh Colour; the latter never yielded any fixed Salt, tho' the *Caput Mortuum* was in a larger quantity.

The Oil of *Amber* has an Odour of Bituminous Oil, which would ſeem to denote that *Amber* is a Bitumen; but there are certain Roſins of which the diſtiled Oil has the ſame Odour.

There is ſome alſo like the *Benjamin*, which yields an Acid, Volatile Salt: But there is none that we know of that yields at the ſame time both an Acid Volatile Salt, and an Oil of a Bituminous Scent. Wherefore the Academy is more inclined to believe that *Amber* is a Bitumen, and conſequently a Mineral.

It is eaſie to ſee how much Light is ſtill wanting to the Academy, before they dare come to a preciſe Judgment upon every thing concerning *Amber*, for they ſhould be informed, *Firſt*, Whether there be not ſome Salt or Vitriolick Water, in the Neighbourhood of thoſe Places, where *Amber* is produced.

Secondly, Whether it be found commonly involved or mixed with Earth, or other particular Subſtances?

Thirdly, Whether there are any Marks or Tokens whereby to diſcover in the Earth, the Places that produce *Amber?*

Fourthly, Whether the Foſſil *Amber* is any ways different from that which is found on the Seaſide?

Fifthly, Whether the White ſort be found in the Earth as well as the Yellow; or, whether the Yellow don't turn White when expoſed to the Air and Sun?

Sixthly, Whether they find any Black *Amber* in the ſame Places where they meet with the Yellow?

Seventhly, Whether it be very ſure, as it is affirmed by *Philip James Hartman*, in his Hiſtory of the *Amber* of *Pruſſia*, and by *Bartholine* upon that of *Denmark*, that there is found of it under a kind of Earth, Foliated and like the Barks of Trees, and that it is attended with a kind of Foſſil Wood, in which however one can't diſtinguiſh neither the Pith nor Fibres, nor Knots, nor Buds. All theſe Facts well atteſted, would give great light into the Nature of *Amber*, and if the Cardinal Primate would be pleaſed to employ ſome skilful Perſon in theſe Enquiries, the Academy would be obliged to his Eminency for their more certain Knowledge therein.

Upon the Generation of IRON.

TO find the Solution of Old Difficulties, is without doubt an Advancement in the Sciences, but it is no leſs ſo, to unravel New Difficulties, and yet more to diſcover ſome in which, at firſt ſight, there appeared none at all.

Monſieur *Geoffroy* enquires here of the Chymiſts, Whether there are any Aſhes in which there is no mixture at all of Iron? One ſhall probably be ſtartled at the Queſtion, for whence can proceed the Impoſſibility? Why ſhould People expect to find any *Iron* in the Aſhes of Burnt-wood? And yet the matter of Fact is certainly true, and thoſe Aſhes have always ſome, at leaſt all thoſe that have been examined by Monſieur *Geoffroy* had *Iron* in them, and it was upon the following occaſion that he diſcovered it.

He had made ſome Artificial *Iron*, compoſed like the common Sulphur, of a Sulphurious Principle, or of an Inflameable Matter, of a Vitriolic Salt, and of a Terreſtrial Subſtance. To repeat the Experiment, and to be the more ſecure of Succeſs, he ſought for an Earth, or Aſhes, perfectly diveſted of Vitriolic Salts, and eſpecially of Ferrugineous Particles, his deſign being to make *Iron*; but whatever Precautions he took, tho' he made Aſhes in Places where there was no *Iron* at all, and tho' he made them of a Wood that had never been ſawed with *Iron*, he could never get them entirely exempt from the Particles of *Iron*; if at leaſt one may reckon among the Particles of *Iron* all ſuch as are attracted by the Loadſtone, which ſeems to be paſt doubt.

It is not probable that theſe Particles of *Iron*, heavy as they are, and ſo little Homogeneous, or Connatural to the Sapp of Plants, can riſe up with them into the Wood, of which the Aſhes were made.

Should it be then likely that every time the Wood is burnt, *Iron* can be produced by the mixture of the Three Subſtances whereof it is formed? Monſieur *Geoffroy* begins to Conjecture it, and nothing could agree better with the Opinion he has already conceived about his Artificial *Iron*; but above all things, we ought to be very well aſſured that there are no Aſhes without *Iron*. *One of the greateſt Difficulties in Philoſophy is, not to be too haſty with new Syſtems.*

Upon a Diſſolution of SILVER.

IF one could reduce Chymiſtry and Phyſicks in general to Kinds of Univerſal Forms, which might contain all the poſſible Caſes, as the moſt ſublime Queſtions of Modern Geometry are reduced, one ſhould be able to foreſee the Changes that would anſwer to the different Hypotheſis or Suppoſitions that one would make; and one ſhould often ſee very ſmall Changes in the Suppoſitions produce very great Variations in the Effects. But Natural Philoſophy is of too great an extent, and too little known, at leaſt till now, and Experience alone teaches us, how great a Power there is in Circumſtances to vary the Phenomena. Monſ. *Homberg* gives a remarkable Inſtance of it, in the Diſſolution of *Silver*, performed by the Diſſolvent of Gold.

The Spirit of Sea Salt is the proper Diſſolvent of Gold, and the Spirit of Nitre is the proper Diſſolvent of Silver. The Spirit of Salt mixed with the Spirit of Nitre diſſolves Gold beſt; 'tis that which predominates in the *Aqua-Regia.* The Spirit of Nitre mixed with the Spirit of Salt ceaſes to diſſolve Silver. 'Tis the Spirit of Nitre that is predominant in the *Aqua-fortis.*

Upon theſe Facts, Monſieur *Homberg* ſuppoſes, with great probability, that the Pores of Gold, which is much heavier than Silver, are more cloſe, and the Points of the Spirit of Salt more fine than thoſe of the Spirit of Nitre; that they are ſo, more than would be abſolutely neceſſary, for the ſmallneſs of the Pores of Gold; that the Spirit of Salt, joined with the Spirit of Nitre, forms a Body of a middling greatneſs, ſtill capable of entering into the Pores of the Gold, in which they have the effect of a Wedge, and ſeparate the ſolid Parts of it; that the Spirit of Salt being united to the Spirit of Nitre, acts more powerfully than if it were alone, becauſe according to the Principles laid down by Monſ. *Homberg*, in his *Eſſays of Chymiſtry*, the Spirit of Nitre is attended and cloathed with a Vegetable or Animal Sulphur, more rarified, more volatile, and more active than the metallick Sulphur that adheres to the Spirit of Salt; finally that the Compoſition of theſe two Spirits does not diſſolve Silver, becauſe the middling Body which they form, is ſtill too fine for the Pores of that Metal; that it is too much at large in thoſe Pores, and conſequently does not make a ſufficient Impreſſion on them.

Theſe Principles being admitted, what Effects can be produced by an *Aqua-Regia* compoſed of the Spirits of Salt and Nitre, but each of them in ſo ſmall a Quantity that they will floatſeparately in the Liquor, and will not meet one another often enough to be united, at leaſt in a great Number of Parts.

This Water may be ſo weak that it will ſeem not capable of diſſolving Gold, and will only aſſume a yellow Tincture, which does not ſenſibly diminiſh the Weight of the Metal. Nor will it diſſolve Silver neither, becauſe of its weakneſs, and in general, it will diſſolve neither the one, nor the other of thoſe Metals, becauſe put which you will of them into ſuch Liquor, there will always be one of the two acid Spirits that will make, as I may ſay, vain attempts againſt the Metal uſurping the place of the Particles of the other Spirit, which might have acted more efficaciouſly, but if ſuch *Aqua Regia* has diſſolved as much of the Gold, as it is able to do, if it has drawn a yellow Tincture from it, it may ſtill diſſolve Silver after that; for the Spirit of Salt, whether all alone, or whether it be united with the Spirit of Nitre, being Employed in keeping diſſolved the few Particles of Gold, it will not attack Silver any more; which by Conſequence receiving the Impreſſion of a greater Quantity of the Spirit of Nitre only, will ſuffer it ſelf to be diſſolved. But this Experiment can't be turned the contrary way; that is to ſay, the *Aqua Regia* can't begin by a ſlight Diſſolution of Silver, and afterwards proceed to diſſolve Gold; the reaſon whereof is, the Spirit of Nitre does not hinder the Spirit of Salt from acting upon Gold, as the Spirit of Salt hinders the Spirit of Nitre from acting upon Silver.

From all which it follows, that if the Spirit of Salt and of Nitre, which we have ſuppoſed to float ſeparately, ſhould come in time to be united in all their Parts, that Liquor would only perform the Office of the *Aqua Regia*, and will diſſolve nothing but Gold; whereas before, when it had diſſolved Gold, it would have diſſolved Silver alſo.

Upon the Nature of IRON.

IRon among all the Metals, is that which has the greateſt Uſes in the Practice of Phyſick, and at the ſame time that which in Speculative Philoſophy moſtly attracts the Curioſity of the Philoſophers, becauſe it has its ſhare in the Phenomena of the Loadſtone. Monſieur *Lemery* the Son, and Monſieur *Homberg*, have both made it an Object of their Studies; the one by the ordinary Chymiſtry, the other by his new Chymiſtry, the only Furnace of which, is the Burning-Glaſs in the Royal Palace.

The Reſult of Monſ. *Lemery*'s Operations is, that *Iron* is an oily Matter, intimately united to an Earth. According to him there is nothing of an acid Salt in that Compoſition, not but one may find ſomething of it in the *Iron*; but as that Metal is pretty much indigeſted, and, as one may ſay, but coarſly wrought by Nature, there may be in it foreign Particles not belonging to its real Subſtance. Thus Acids may be admitted into its Pores without being any way a Principle of this Mixture; and ſo far are they from being Principles, that Monſ. *Lemery* ſhews, they are its Diſſolvents; that is to ſay, its Enemies and Deſtroyers. The Spirit of Salt, of Nitre and other Acids diſſolve *Iron*; and when it is ruſty, it is diſſolved either by the Acids of the Air, or by thoſe it contained in its Pores, and which Water or ſome other Liquor has put into motion. If it ſhould hereafter appear that

Acids are excluded from the intimate Compoſition of *Iron*, there muſt be a Reſtriction to the Formation of artificial *Iron*, mention'd in the Hiſtory of 1704, and it muſt be owned that the Acids that enter'd therein were not neceſſary to it.

Vitriol is *Iron* intimately mixed with an acid Spirit; and with ſuch a Compoſition one may make Artificial Vitriol, very like the Natural. Monſieur *Lemery* having diſſolved both the one and the other Kind of Vitriol over a great Fire, he extracted the acid Spirit from them, attended with a very ſtrong Odour of common Sulphur, which laſted ſeveral Months after the Diſtillation. Vitriol calcined, and made *Colcofar*, being again melted over a very violent Fire, which made it yield a freſh Odour of Sulphur, there remained at laſt in the Veſſel, a black rarified Powder, which the Loadſtone attracted as ſtrongly as it does *Iron* or *Steel.*

We know that common Sulphur is compoſed not only of an oily Matter, but likewiſe of an acid Spirit, without which, the former would not be Inflameable. It is therefore very probable, that in the Vitriols there is formed a common Sulphur, by the Union of the acid Spirit with the oily Particles of *Iron*; and that this Sulphur becomes ſenſible to the Smell by the Action of the Fire. The black Matter that remained after all the Operation was ſtill *Iron*, ſince it could be drawn by the Loadſtone, but it was an *Iron*, either almoſt or altogether diveſted of its oily Parts. Therefore it was no longer Malleable, for it is its oily Parts that give it the Facility of being beaten out with the Hammer, but it was become fryable or brittle almoſt like a Stone; it could be hardly any longer diſſolved by any Acid, becauſe the Acids that ferment violently with the Oils could take no more hold upon it, and by the ſame reaſon alſo, it would no more ruſt.

The ſame Operations that were made upon the Natural and Artificial Vitriol, were likewiſe made upon the Ruſt of *Iron*, the moſt perfect that could be got, and the ſucceſs was in a manner the ſame. As Vitriol has more Acid in it than the Ruſt of *Iron*, and that the oily Parts are not ſeparated from theſe mixed Bodies, but in proportion to the quantity of the Acid that carries them off, there was more of the oily Parts ſeparated from the Vitriol than from the Ruſt, and conſequently the Matter that remained of the Ruſt, after the Operations were over, was in a better ſtate to be ſtill imperfectly diſſolved by ſome Acids. It appears then, that the Parts of *Iron* are ſeparated, and even eaſily enough, with reſpect to the difficulty of uncompounding other Metals. 'Tis from thence that it becomes uſeful in Phyſick, and probably the good Effects that are produced by it are owing to its oily Parts, ſeparated from the Earth by the Chymical Operations made in the Bodies of Men.

Monſ. *Lemery* having appropriated the oily Parts of *Iron* to Medicinal Uſes, he gives the earthy Parts to the Magnetick Phenomena; not that all Kinds of Earth can be proper for it; for there muſt be a very particular Diſpoſition of the Pores, and perhaps it is the oily Matter that molds and faſhions them as far as is neceſſary for that purpoſe. Hence Monſ. *Lemery* conjectures that the Loadſtone might have been *Iron* originally, from which the Heat of the Earth had ſeparated the oily Parts. In ſhort, no more is wanting to make the whole Difference between a Metal ſuch as *Iron*, and a Stone, ſuch as the *Magnet*, and it is known how much thoſe two are alike otherwiſe.

How comes it then that the *Iron*, diveſted of its Oil, and reduced to ſuch a State as was done by Monſ. *Lemery*, does not attract as well as the Loadſtone? The Anſwer is at hand; the *Iron* is then a Powder, and the beſt Loadſtone in the World being beaten to Powder does no longer attract; the Cauſe of which is this, there is no Vortex or Whirl-pool formed about each little Grain, or if there be, it is not ſtrong enough: Nor is there any formed about all the Grains together, which have not among themſelves any regular continuation of Pores; the Powder of Loadſtone which has loſt its attractive Quality, is always drawn exactly after the ſame manner as the earthy Parts of the *Iron*.

If *Iron* diſpoiled of its oily Parts, was not reduced to a Powder, and if it were beſides ſufficiently expoſed to the Current or Stream of the magnetick Matter, ſo as it could collect and retain a Vortex about it ſelf, it would, according to this Syſtem, become a real Loadſtone. It is thus that Monſ. *Lemery* pretends that ſome ruſty pieces of an *Iron-Bar*, that was in the Belfry of *Chartres* did acquire a Magnetick Virtue: The Acids of the Air, or the foreign Acids lodged in the Pores of the Metal, had diſſolved the oily Parts of its Superficies, the Heat of the Sun had in length of time carried off, both the Diſſolvents and that which they had diſſolved, and the Magnetick Matter that circulates about the Terreſtrial Globe, had for a pretty long time paſſed into this *Iron* which was deprived of its Oil. According to Monſ. *Lemery*, *Iron* is not changed into a *Magnet* on account of its Ruſt; it is only diſpoſed to ſuch a Change, and it muſt afterwards be unruſted; that is to ſay, the Oil diſſolved by the Acid, muſt be ſeparated from the *Iron*. Now tho' Mon. *de la Hire*, as we have related it in the Hiſtory of 1705, does attribute the Change to the Ruſt, it would not perhaps be hard to reconcile thoſe two Opinions.

On the other hand Monſ. *Homberg* examined the Nature of *Iron* by the Burning-Glaſs, and his Diſſertation upon that Subject, publiſhed in 1706, gives the Detail of his Experiments, to which we muſt refer the Reader, ſince it neither can nor ought to be Abridged, by reaſon of the too great Number of the little nice Circumſtances, all of which are important. The principal Conſequences that flow from Monſ. *Homberg*'s Obſervations are theſe:

1. That *Iron* has a certain quantity of ſuperfluous oily Matter, which is ſeparated from the Parts that are truly Metallick; and this confirms what we have ſaid above, that *Iron* is an ill-digeſted and ill-wrought Metal.

2. That this oily Matter, or the Sulphur of the *Iron*, being joyned to Coal, or ſome other Matter of the like Nature, is inflameable. Perhaps that is an Effect of the Union of this Sulphur with the Acids of the Coal.

3. That the Sulphur of *Copper* is inflameable like that of *Iron*, but ſo is not the Sulphur of *Gold* or of *Tinn*; tho' Gold, Copper and Tinn, are three Metals very Sulphureous. It is very probable,

bable, that without the aſſiſtance of this Burning-Glaſs, one ſhould never be able to diſcover theſe nice differences between the intimate Principles of the Compoſition of Metals.

* * *

Upon the Nature of HONEY.

WE do no longer believe, like the Ancients, that *Honey* is formed of the Dew which falls upon Flowers; nor is it any longer taken for a Production of the Air, or a Preſent from Heaven. The Bees do not gather it till after Sun-riſing, at the Time when there is no longer any Dew, and what they take upon the Flowers, muſt either be a Liquor which is prepared there, and which comes out of the Flowers by particular Veſſels, as the Manna comes from the Aſh of *Calabria*, or rather the fine and looſe Duſt in the Stalks of Flowers; for according to the Obſervations that Monſ. *du Verney* has formerly made upon this Matter, the Bees only apply themſelves to theſe Stalks, and not to the places from whence any Liquor can proceed.

Monſ. *Lemery* has examined the Nature of Honey by Chymical Reſolutions: He has tried that of different Countries, from *Narbonne*, *Champaigne* and *Normandy*; the Honey diminiſhes in goodneſs according to the Order of theſe Places that have been named; but there is little difference in the Analyſis of them.

Three quarters of the Subſtance of Honey goes off in Liquor by Diſtillation. Of this Liquor, which changes according to the Degrees of the Fire, and the Length of the Operation, there is above a fourth Part, which is nothing but an inſipid Water to the Taſt, and yet Acid in it ſelf, becauſe it will turn the Marigold red; almoſt all the reſt is a Water ſenſibly Acid, which is called the Spirit of Honey; there comes but very little Oil from it. The fourth Part of the Subſtance of the Honey that remains ſolid is a black and light Coal, which when thrown into Water, boils in it like Chalk. By Lixiviation they extract a little Alcali Salt from it.

Of all that proceeds from the Honey, nothing preſerves the taſt of it, nor even any taſt like it, but this is no wonder; the Savour as well as all the other Properties of mixed Bodies depends upon a certain Concatination of Principles. Monſ. *Lemery* is of Opinion that Sweetneſs proceeds from a cloſe Mixture of an Acid with a Sulphur, or with an Oyl that temperates and corrects it; he ſupports his Conjecture by the inſtance of Sugar of Saturn, ſo called from its Sweetneſs, which is Lead, a Metal inſipid in its ſelf, but very Sulphureous, diſſolved by an Acid. It is not always eaſie for Art, neither to make a Mixture ſufficiently intimate of the two Matters that compoſe Sweetneſs, nor exactly to hit upon the Doſe thereof.

Monſ. *Lemery* had a mind to try whether the Spirit of Honey rectified would diſſolve Gold and other Metals, as ſeveral Chymiſts have maintained. He found that this Spirit did extract a yellowiſh Tincture from Gold, and a little Odour without Tincture from Copper; that it penetrated Iron, Lead and Mercury; but not Silver nor Tinn.

Upon the Iron of PLANTS.

THE Operations of Monſieur *Lemery* upon Honey have furniſhed him with an Anſwer to a Queſtion propoſed by Monſ. *Geoffroy*, in the Hiſtory of 1705. *Whether there can be any Plants without Iron?* No matter drawn from Plants ſhould ſeem to be more exempted from Iron than Honey, which is nothing but a very fine Extraction from Flowers, wrought again in the Bowels of the little Body of a Bee; nevertheleſs Monſieur *Lemery*, after having taken all poſſible Precaution againſt any *Iron* that might have accidentally been mixed with his Operations, found in the black Coal, that remained from the Diſtillations of Honey, ſmall Grains that were drawn up by the Loadſtone.

Moreover Monſieur *Lemery* found ſome *Iron* likewiſe in the *Caſtoreum*, which is a Matter proceeding from an Animal.

From hence it muſt follow, either that ſome other Subſtance, beſides *Iron*, can be attracted by the Loadſtone, or that there is *Iron* formed by the Calcination that makes the Aſhes, or finally, that it is really contained in Plants, and even in ſome of the Parts of Animals too. Monſieur *Lemery* holds the latter.

Theſe Grains extracted from Plants, and upon which the Loadſtone acts, are melted with the Burning-Glaſs, exactly after the ſame Manner, and with the ſame Circumſtances as the Filings of *Iron*; why then ſhould it not be real Iron?

One ought to preſume that it is ſo, if nothing hinders us from believing it, and it is by following this kind of Reaſoning that Monſieur *Lemery* anſwers all the Difficulties which may be objected. As narrow as the Tubes and Veſſels of Plants are, he proves, that *Iron* may be divided into Particles ſmall enough, to paſs eaſily thro' them. As heavy as it is, it can be raiſed when diſſolved in a Liquor; it is beyond diſpute that there are Particles of Earth that aſcend into ſuch Veſſels.

A more particular Enquiry into the Facility wherewith *Iron* is raiſed up into Plants, has led Monſieur *Lemery* to a curious Experiment. Upon a Diſſolution of Filings of *Iron*, by the Spirit of Nitre contained in a Glaſs, he poured Oil of Tarter *per Deliquium*; the Liquour ſwelled very much, tho' with a moderate Fermentation, and a little while after it had reſted, there aroſe kinds of Branches faſtened to the Superficies of the Glaſs, which continuing ſtill to ſpread and grow, cover'd it at laſt entirely, and then ſpread themſelves even upon the External Superficies. The Figure of the Branches is ſo perfect, that one may diſcover in them even kinds of Leaves and Flowers, and this Vegetation of Iron may as juſtly be called the *Tree of Mars* as a Vegetation of Mercury, tho' in a different manner, has been termed the *Tree of Diana.* If the Liquor which in aſcending gets over the Glaſs, without making any Branches, is turned upſide down, it quickly begins to aſcend again, and is congealed into Branches, either wholly or in part; ſo that you need only turn the Glaſs, and that which remained Liquid about it, will at length be all ſpent in the Formation of the Tree. There is ſome ſmall Variation in the Effects, which depends upon the Doſe of the Diſſolution of *Iron*, and of the Oil of Tartar.

The extream Volatility of this Liquor can only be attributed to the *Iron*, ſince it is certain that the Spirit of Nitre and the Oil of Tartar mixed together would not produce ſuch a Vegetation. From thence Monſieur *Lemery* eaſily comprehends how *Iron*, diſſolved in the Earth by Acids, aſcends even to the Tops of Plants, and perhaps it likewiſe helps the Elevation of the Sapp; he might fancy too, that the Figure which the *Iron* naturally takes, when it aſcends in the Glaſs, may contribute to that of thePlants, where it is contained, and does in ſome manner cauſe them to put forth Branches; but this Conjecture is a little too new yet, and even contrary to ſeveral ſtrong Appearances, and muſt therefore be propoſed with Caution. *It is good to venture ſometimes after this manner as Phyſicians do with their Medicines, but then you muſt follow their Example, and uſe the neceſſary Precautions.*

Upon what becomes of the AIR *that enters into the* LUNGS.

IT ſeems as if every thing becomes Difficult the more we fathom into it, and that one need only examine a Matter with greater Care, and thro' all its Relations and Dependances, in order to be more inquiſitive about the Explanation thereof.

We have ſeen in the Hiſtory of 1700, that Monſ. *Mery* does not allow that the Air received into the Body by Reſpiration, and then mingled with the Blood, can afterwards get out thro' the Pores of the Skin, with the Sweats, or all that great quantity of Matter which we continually perſpire. His ſtrongeſt Argument is, that Animals put into a *Vacuum* ſwell by the Dilatation of the Air contained in their Bodies, which Air cannot get thro' their Skin without burſting it. This ſeems concluſive enough, notwithſtanding which, a Philoſopher has offer'd a conſiderable Objection againſt it, *viz.* Take a little Sweat, put it into a Veſſel, and place it *in Vacuo*, you will ſee the Air come out of it, as it does out of all other Liquors; therefore there is Air in Sweat, and conſequently it can, and even ought to come out with it, by the Pores of our Skin.

In Anſwer to this Difficulty, Monſieur *Mery* diſtinguiſhes two Kinds of Air contain'd in the Bodies of Animals, or rather two different Ways by which it enters them. There is Air intimately mixed with all the Food, whether it be Liquid or Solid, that Living Creatures uſe; beſides which they continually take in Air in the Maſs, by Reſpiration. The Blood which is formed from Food, is all Impregnated with the Air incloſed therein; and Monſieur *Mery* conceives, that as the Food had taken in as much Air as it could contain, the Blood was in the ſame Diſpoſition, and like to Water that has diſſolved all the Salt it was capable of imbibing. But as the Water may ſtill admit Salt into a Maſs which it cannot diſſolve, ſo the Blood receives by Reſpiration a Quantity of Air that does not intermix with it, but remains in a Maſs, and only ſerves to quicken its Circulation. The Air that comes out of Sweat *in Vacuo*, is what was intimately mixed with it, and likewiſe with all the other Liquors of the Body; but the Air taken in by Reſpiration, remaining always in the Maſs, goes out likewiſe after the ſame manner, and conſequently muſt take the ſame way in going out as it did in coming into the Body; that is to ſay, as it paſſed from the Veſicle of the Lungs into the Extremities of the Capillary Veins of the ſame, and from thence is carried with the Blood to the Extremities of all the Capillary Arteries of the Body; ſo it muſt paſs from thoſe Extremities to thoſe of the Capillary Veins with the Blood, and finally follow it even to the Extremities of the Capillary Arteries of the Lungs; from whence it will repaſs alone into the Veſicles of the Lungs, and from thence into the *Trachea* by which it firſt came in.

One may make ſeveral Reflections, and pretty well founded too, in favour of Monſieur *Mery*'s Syſtem.

I. One can ſcarce imagine that the Air which Animals reſpire, has any other Function rendering it abſolutely neceſſary, beſides that of helping the Circulation of the Blood. Now in order to promote that, it ſeems as if it ought to be in a Maſs. We ſee daily that Air in a Maſs contained among the parts of a Water, which is to make a *Jet* or *Caſcade*, forces it up higher than it would have riſen naturally, and it is certain that the Air intimately mixed with it, that is to ſay, the ſame that could be drawn out of it *in Vacuo*, never produces ſuch an effect. It has no other motion but that of the Water with which it is confounded, and it does not communicate to the ſaid Water a new Impulſe upon any occaſion, that only belongs to the Air which preſerves it ſelf always unmixed, and which makes an effort to break thro' its Confinement. What we have here ſaid of Water is of it ſelf applicable to the Blood.

II. If the Air in the Maſs is neceſſary to the Blood for Circulation, it is yet more ſo to the Blood of the Veins, than of the Arteries; for as we have ſaid in the Hiſtory of 1700. *The Veins have hardly any Spring in Compariſon of the Arteries, and they contain almoſt half as much more Blood, and conſequently have more want of a Foreign Force to help them in Circulating it.* The Air being arrived with the Blood at the extream Parts of the Arteries, muſt therefore paſs into thoſe of the Veins, and conſequently it does not get away thro' the Pores of the Skin.

III. If the Air that has been reſpired enters into the Veins, it can't come out again from the Body of the Animal (tho' it certainly does come out,) but by the way that Monſieur *Mery* has Contrived for it.

IV. Since Experience does certainly teach us that there goes out as much Air by *Expiration* as there comes in by *Inſpiration*; it is impoſſible that any part of it can perſpire by the Pores of the Skin.

V. As the Air received into the Blood by Reſpiration does continually ſtrive to break looſe from it, and thereby contributes to its Motion, it can't free it ſelf, but when it meets with Paſſages thro' which the Blood can't follow it. Now it does not meet with any ſuch but when it is arrived by Circulating at the Extremities of the Capillary Arteries of the Lungs. There the Veſicles of the Lungs preſent themſelves, ſo diſpoſed as to admit of the Air, and to exclude the Blood; and this Effect of their Diſpoſition is inconteſtable, ſince they are always full of Air, and that the Capillary Arteries, which are terminated there in an infinite Number almoſt, diſcharge none of their Blood into hem, at leaſt if the Lungs be Sound.

Monſieur *Mery* ſupports his Syſtem by three Experiments; if one ſquirt Water and Milk by the Trunk of the *Vena Cava* into the right Ventricle of the Heart, the Liquor which from this Ventricle diſcharges it ſelf into the Lungs by the Pulmonary Artery, paſſes from the Capillary Arteries into the Veins without entring the Veſicles, and conſequently the Air, which is intimately mixed with it, takes the ſame way; which is a ſufficient Proof that it is not the Air intimately mixed with the Blood, which being arrived at the Extremities of the Capillary Arteries of the Lungs, that ſeparates it ſelf therefrom, to go into the Veſicles, and to come out by the *Trachea.* Moreover, if one blows Air by the *Trachea* into the Veſicles, it paſſes from thence into the Veins, and not into the Arteries, for it goes entirely into the left Ventricle of the Heart; a plain Sign that the Arteries which don't admit the entrance of the Air when it is in a Maſs, are deſtined for its coming out, ſince it muſt finally come out again, and in the ſame quantity as it went in. Laſtly, If one opens the Belly of a Living Dog, and pricks the *Vena Cava* above the Emulgent Arteries, one ſees that in proportion to its diſcharging the Blood, it is filled with Air, which paſſes into the right Ventricle of the Heart. It could not have received that Air but by the ſame Capillary Veins, which it received the Blood it contained, and conſequently the Air takes that Courſe that Monſ. *Mery* has deſcribed.

His whole Syſtem ſuppoſes a great Difference between the Air contained in a Maſs in any Liquor, and that which is intimately mixed therewith; he conceives that the latter ſort of Air is of a Figure adapted to the ſmall Parts of the Liquor, and whilſt it continues in that State, has no other Property belonging to it. This Notion might yet require ſome Explanations, but it is ſufficiently eſtabliſh'd already by other Syſtems, where it appears neceſſary; and *if one would trace all the Difficulties quite to the end of 'em, each little particular Syſtem would lead us to the general Difficulties in Phyſicks.*

Upon the different Kinds of VITRIOLS, *and particularly of* INK *made with Vitriol.*

IT is not very Common, and conſequently more agreeable, to underſtand any matter thoroughly, and to ſee a Syſtem ſupporting itſelf equally on all ſides; that of Mr. *Lemery* the Son, about his *Tree of Mars*, may have afforded us one Spectacle of this Philoſophical Pleaſure; here is another Inſtance from the ſame hand. At firſt the queſtion will only be about common Ink, but that will carry us to much loftier Speculations.

The Solution of *Vitriol* mixed with the Tincture of the Gall-Nut, becomes immediately very black, and that is the *Ink* we uſe in Writing. Monſieur *Lemery* conjectures, that as the Vitriol of which we make Ink, is nothing but Iron diſſolved by an Acid, with which it was intimately mixed, and that on the other hand, the Gall-Nut is an *Alcali* or *Abſorbent*; that *Alcali* meeting with the Acids which kept the Iron diſſolved, joyned it ſelf to them, and made them looſen their hold upon the Iron, which thereupon revived, and appeared again in its natural Blackneſs. Thus it is properly, with Iron that we write; but in order to communicate this uſe to it, it was neceſſary that it ſhould be firſt divided into Parts almoſt infinitely ſmall, as it is in Vitriol; and that after having been ſo ſubtily and minutely divided, it ſhould be ſeparated from the Agent that had cauſed the Diviſion, and which kept it concealed.

Every thing concurs to eſtabliſh this Hypotheſis of Monſ. *Lemery*: Of the five Kinds of Vitriol, that which takes its Name from *Cyprus* or *Hungary* is only one, whoſe Foundation is of Copper; whereas the reſt are of Iron; and that Vitriol is the only one that does not make Ink. The Spirit of Vitriol, mixed with Tincture of Galls cannot make Ink, becauſe it has no longer thoſe Ferrugineous Parts which it kept diſſolved. The ſame Tincture of Galls mixed with Filings of Iron, makes Ink, but not ſo readily as when it acts upon a Solution of Vitriol; becauſe in ſuch a Solution it finds the Iron divided as much as it ſhould be, whereas it is obliged it ſelf to divide that which is the Filings. It makes Ink with the Diſſolutions of Iron by the Spirits of Salt, Nitre, Sulphur, Alom and Vinegar, as well as with the Diſſolution of Iron by the Spirit of Vitriol. If after your Ink is made, you throw into it a few drops of the Spirit of Vitriol, the Blackneſs will diſappear, becauſe the Iron does re-unite it ſelf to a new Acid, and becomes Vitriol again. By the ſame Reaſon Acids will fetch out the Spots of Ink.

If *Alcali*'s or *Abſorbents*, ſuch as Chalk-Water, Spirit of *Sal Ammoniac*, Oil of Tartar, do not make Ink with Vitriol as well as the Tincture of Galls, Monſieur *Lemery* anſwers, that the former are united to the Acid that keeps the Iron diſſolved, but does not ſeparate it from the Iron, as the Gall-Nut does; and why does this latter releaſe the Iron from its Acid? It is becauſe it is Sulphurious, and conſequently is more Active, whereas the other *Abſorbents* are more Saline and Earthy: And that which proves this Opinion is, that if one animates them by the addition of ſome Sulphur, they become fit for making Ink. Iron was the *Alcali* impregnated with the Acid of Vitriol, and as Iron is always very Sulphurious, another *Alcali* muſt not be leſs ſo, in order to deliver it from the Power of its Acid.

If the Iron when ſeparated from its Acid is not precipitated to the bottom of the Liquor, as it happens to other Metals, abandon'd by their Diſſolvents, the reaſon is, becauſe it is not ſo heavy; and beſides the Tincture of Galls being Sulphurious, does by its Viſcoſity bear it up; to confirm which Notion, Monſieur *Lemery* has found that other Matters which ſuffer'd Iron to ſink, would ſuſtain it when any viſcous Subſtance was mixed with it.

Thus you have the whole Mechaniſm of Ink amply Explained, and curiouſly Traced even to its ſmalleſt Dependencies; from thence Monſieur *Lemery* paſſes to Obſervations and Reflections more neceſſary and profitable.

Vitriol taken inwardly, is of great uſe in Phyſick, but it is that of which the Ground is Iron; for if the Copper ſhould predominate, it might be very dangerous. The Blackneſs which a Solution of Vitriol will receive from Galls, and the different degrees of that Blackneſs, will make you diſcover whether it contains Iron, or whether there be any mixture of Copper in it.

Monſieur *Lemery* has found by various Trials that the Vegetables that are reckon'd among aſtringent Medicines, ſuch as the *Sumac*, the Bark of *Grenada*, the *Balauſtes*, &c. are proper as well as Galls to make Ink: That the Purgatives, ſuch as *Senna*, *Manna*, *Jolap*, *Agaric*, &c. make none;

and laſtly, that the Purgatives which like *Rhubarb*, and the *Mirabolans*, bind and ſtrengthen, after having purged can make Ink; from whence there follows a very ſure and eaſie manner of trying the Qualities of a Vegetable, with which one is not acquainted.

* * *

A Second Diſſertation upon the Nature of IRON.

[*See* Page 327.]

IT is good that there ſhould be Diſputes ſometimes among the Members of the Academy, and may be they happen but too ſeldom. *The particular Intereſt one has to ſupport what one has once laid down, animates and warms the Love one bears in general to Truth.*

We have ſeen in the Hiſtory of 1704, that from a Mixture of Sulphur, or other inflameable Matter, from a Vitriolick, Salt and from an Earth, Monſ. *Geoffroy* has been able to produce Iron. In one of his Operations, Clay furniſhed him with a vitriolic Acid, as well as with Earth, and Linſeed-Oil was inſtead of Sulphur; in another the Oil of Vitriol provided the Acid, the Oil of Turpentine the Sulphur, and both of 'em the Earth. As he had obſerved that there are always found ſome Particles of Iron in the calcin'd Aſhes of Plants, he believed that this Metal might alſo be there formed by the Re-union of the three ſame Principles; and to aſſure himſelf whether this Effect was neceſſary and infallible, he put the following Queſtion to the Chymiſts in the Year 1705, 1705, *Whether it was poſſible to find any Aſhes of Plants without Iron?*

Monſ. *Lemery*, the Son, was of Opinion that the Iron contained in the Aſhes of Plants, was not there formed by Calcination, but that it had really been before in the Plants themſelves, and aſcended into their Veſſels with the Juices of the Earth: That led him to the Diſcovery of his *Tree of Mars*; mention whereof has been made already both in the Hiſtory of 1706, and alſo in that of the preſent Year.

He ſtill ſtands by his firſt Opinion, that all the Matters from whence Monſ. *Geoffroy* extracted Iron did really contain it. It is found, and it is not material whether is be in a great or a ſmall Quantity, not only in Clay from whence it is viſibly attracted by a Knife touched with a Loadſtone; not only in the Oil of Vitriol, which proceeds from a Mineral whoſe Foundation is Iron; but likewiſe where one would leaſt have ſought for it, in Linſeed-Oil, in that of Turpentine, ſweet Almonds and Olives; and he relates the Operations, whereby he reduces theſe Oils to an Earth, in which Iron is found.

Monſ. *Geoffroy* anſwers, that what Method ſoever is taken to extract Iron from Clay, one ſhall find infinitely leſs of it there alone, than when one has mixed it with Linſeed-Oil, and that conſequently, 'tis the mixture that produces Iron; that as for the ſeveral Oils he mentions, it is certain they are not ſimple Subſtances, but Bodies compounded of an Earth, an Acid, and of ſulphureous and inflameable Parts, which are exactly the three Principles that he requires to the Formation of Iron; and that according to all Appearances, theſe three Principles ſcatter'd throughout the mixed Bodies, are reunited by Monſieur *Lemery*'s Operations.

From this Anſwer of Monſ. *Geoffroy*, it follows that the vegetable Matters contain the Principles of Minerals; and he adopts that Conſequence, which, tho' Paradoxical, is yet conſiſtent enough with the great Uniformity of Nature. He is likewiſe obliged not to allow Mercury to be a Principle of Iron; which, however, commonly paſſes for the Foundation of all Metals. He even hints that it is poſſible there is nothing of Mercury in any of them; and that Sulphur, Acid and Earth are ſufficient. Their different Doſes, their Union more or leſs ſtrong, their different Manners of uniting themſeves would ſolve all. Monſ. *Geoffroy* ſhews by ſeveral curious Experiments, that Iron, Copper, Lead and Tinn, diveſted of their Sulphur and reduced to an Earth, which may be vitrifyed either by a great Fire or by the Burning-Glaſs, do reſume their metallick Forms, when one reſtores to them a Sulphur even vegetable. As for Gold and Silver, the Experiments made by the Burning-Glaſs do ſufficiently demonſtrate their Sulphur; but when they have been once reduced to an Earth or vitrifyed, the Chymiſts have not hitherto been able to bring them back to their former State, by the addition of ſome new Sulphur; however there is no reaſon yet to deſpair of it, and if they could ſucceed, we ſhould be ſure that Mercury does not enter into their Compoſition, no more than into that of the Imperfect Metals; and that for the artificial Production of the two perfect Metals, one need only know what are the Earths proper and peculiar to each one; ſince by the union of ſome Sulphur, they would become a Metal, juſt as Clay, according to Monſ. *Geoffroy*, becomes Iron.

Thus far has this artificial Iron exalted the Notions and Hopes of its Author; but it muſt be owned, they are as yet no more than bare Notions and Hopes; many Difficulties ſtill remain to be ſurmounted.

To return to the exact Point of the Queſtion that lies between Monſ. *Lemery* and Monſ. *Geoffroy*: It is pretended by the former, that even tho' the latter ſhould have really made Iron, he could not infer from thence, that the Iron of the Aſhes of Plants did not really exiſt in the Plants; and that it is only an effect of Calcination: For when one Analyzes Vitriol, one finds Iron in it, but can one ſay that that Iron is an effect of the Analyſis and of the Fire? Surely no; ſince in compoſing Artificial Vitriol exactly like the Natural, Iron is actually uſed in it, which is extracted likewiſe by the Analyſis, tho' it diſappeared in the Mixture. Monſ. *Lemery* promiſes Anſwers yet more preciſe to Monſ. *Geoffroy*'s Syſtem; but *Anſwers that one founds upon Facts and Experiments, require a little more time than thoſe that depend upon turns of Ingenuity.*

Upon MUSHROOMS.

THE Moderns, whether by the help of the Microſcope, or by a certain exactneſs in their Enquiries, which is almoſt as peculiar to them, as the Microſcope it ſelf, have diſcover'd the Seeds of ſeveral Plants, which were formerly ſuppoſed to have had none, ſuch as, for inſtance, thoſe of the *Fern*, of the *Polypode*, &c. theſe Seeds are ſo ſmall, or ſo ſtrangely placed, that they are not to be diſtinguiſhed by the naked Eye, or if they be ſeen, may be eaſily miſtaken for ſomething elſe.

We are ſtill in the ſame Caſe with the Ancients in relation to *Muſhrooms* and ſome other Plants. What Induſtry ſoever has been uſed, what Hints ſoever given that the Seed may be conceal'd in ſome Parts where one does not naturally think to look for them, we have not yet been able to find any of them. The Culture even of Muſhrooms might ſeem to confirm us that they have none. Monſ. *Tournefort* has given a very exact, Inſtructive, and particular Account of them, and it is ſo much the more Curious, as it augments the Wonderfulneſs of their Production. In general they ſpring from the Dunghil, and eſpecially from ſuch as are made with the Excrements of Horſes; the Birth of all of 'em may be reduced to that. But what Relation is there between ſuch Dung and Muſhrooms? What Vertue has the one to produce the other? One might as well believe with the

Ancients therefore, that the Carkaſs of an Ox being corrupted produces Bees; that the ſpinal Marrow of a dead Man, being a good while expoſed to a very hot Sun, is turned into a Serpent, &c. for theſe Metamorphoſes ſo remote and ſo improbable, are not more ſo, than that of Horſe-dung and Muſhrooms.

But we muſt return to ſome certain Principles Philoſophical and Rigorous, which may ſet bounds to meer Poſſibilities, too uncertain and too indefinite. When we conſider how complicate the Structure of a Plant is, and how delicately compoſed, it is wholly unconceivable, that it ſhould reſult from a fortuitous Concourſe of ſome Juices differently agitated. It is alſo as little to be conceived that this fortuitous Concourſe ſhould at the ſame time be both ſo Regular, as always to produce in the ſame Kind an Infinity of Plants perfectly alike, and ſo limited, in ſpight of the infinite extent that Chance ought to have, as never to produce any Kind that had till then been utterly unknown. Beſides, as ſoon as one can perceive the ſmalleſt Part of a ſpringing Plant, we ſee it already quite formed, and are ſenſible that it does nothing more afterwards but unfold it ſelf and increaſe; a certain Token that nothing more has happen'd to it from the firſt inſtant of its Birth; for could it be the Time wherein we begin to ſee it, that ſo ſuddenly changes the whole manner of Nature's Operation? In ſhort, the Number of Plants that are allowed certainly to have Seeds, and that do ſpring from thence, is incomparably the greateſt, and thi is a very ſtrong Philoſophical Prejudice in favou of all the reſt; or to ſpeak more properly, 'ti much more than a Prejudice. If the Ancients had conſider'd all theſe Things, they would not ſo eaſily have believed that there are any Plants without Seed.

We ſhould be ſtill leſs excuſable than they, if we ſhould think like 'em; we I ſay, to whom the Number of Plants that have no viſible Seeds is much ſmaller. We may then aſſert without fear, that they all have; and aſſure our ſelves that if our Experience can ever go ſo far as to unravel the Fact, we ſhall be juſtified by it.

But it is moſt certain, that the Seeds of Plants cannot be diſcloſed every where; they muſt meet with certain Juices, proper to penetrate their Coverings or Skins in the firſt place, next there muſt be a Fermentation excited by the ſaid Juices, which is the chief Principle in the unfolding or opening of the little Plant, and laſt of all thoſe Juices muſt join themſelves, and augment the little parts of the Plants. From thence proceeds the infinite Diverſity between the Places that produce and nouriſh different Plants. There are ſome that are not produced but upon other particular Plants, of which the Trunk, or the Bark, or the Roots have alone the Juice that is agreeable to them. What Monſieur *Tournefort* has heard from Meſſieurs *Mery* and *Lemery*, is yet more ſurprizing: There are a kind of Muſhrooms that grow upon the Bands and Plaiſters applied to the Wounds and Sores of the Sick-men in the Hoſpital called *L'Hôtel-Dieu.* After this, no body will wonder that Horſe-dung prepared, as Monſ. *Tournefort* mentions, ſhould be a kind of Soil or Bed capable of bringing forth the ordinary Muſhrooms.

It follows from thence, that the Seeds of Muſhrooms muſt be ſcatter'd in a pretty large Quantity in an infinite Number of places where they never appear, and indeed over all the Earth, by Conſequence likewiſe the inviſible Seeds of a great Number of other Plants. It muſt be owned that the Imagination is ſhocked at firſt with the Conſideration of ſuch a prodigious Multitude of different Seeds, ſowed every where indifferently, and in an infinity of places in vain too; and yet when one comes to weigh the Matter, one muſt allow it. From whence come otherwiſe the marſhy Plants that are found in Lands turned to Fenns and Marſhes, and which never appeared therebefore? From whence come thoſe new Plants that other Accidents ſeem to have produced ſometimes in certain places; for inſtance, the black Poppies that grow in the burnt Grounds in *Languedoc*, in *Provence*, and in the Iſles of the *Archipelago*, and which are ſeen no more the following Years? From whence that great Quantity of *Eryſimum latiſolium majus glabrum*, which appeared after the Fire of *London* upon more than 200 Acres of Ground where that happen'd, *&c*? Theſe Kinds of Facts, and many others, which one might alledge equally inconteſtable, prove at the ſame Time both the great multitude of Seeds ſcatter'd every where, and the want of certain Circumſtances to make them appear.

This Syſtem is ſo much the more probable; Firſt, becauſe it is now certain that thoſe Plants which were thought to have had no Seeds, are now found ſome of 'em to have moſt of all. Secondly, that theſe little Seeds may be more eaſily tranſported into an infinite number of Places by a thouſand different Chances. And, Thirdly, By reaſon of their extream Smallneſs, they are the better ſecured from external Injuries, and are longer preſerved without any Alteration. One may add, that by the ſame reaſon, they are more nice in the Choice of the Juices, by which they are to be unfolded, and ſtand in need of more particular and uncommon Circumſtances.

If to this Speculation upon the inviſible Seeds of Plants we joyn that of the inviſible Eggs of Inſects, which is exactly parallel, the Earth will be found full of an inconceivable number of Vegetables and Animals already perfectly formed and deſigned in Miniature, and which only ſtay for certain favourable Accidents to appear in full length; and *one may gueſs, tho' yet very imperfectly, how rich that Hand muſt be which has ſown them all in ſo great a Profuſion.*

Upon the JUICE *that nouriſhes* PLANTS.

Beſides the Reſemblance that there is between Vegetables and Animals by their Seeds and Eggs, they have ſtill another, and that a pretty perfect one too, by the Liquors and Juices that nouriſh 'em, and a certain general Plan of Structure is ſo analogous to each of 'em, that one is almoſt tempted to think that Vegetables are Animals, wanting only Senſation and voluntary Motion.

Monſ. *Reneaume* has communicated ſome Obſervations upon the nouriſhing Juice of Plants, and particularly concerning the Tranſpiration thereof. It is above 160 Years that two *Franciſcan* Monks began to undeceive the World about the *Manna* of *Calabria*, which was thought to fall from Heaven, and they diſcover'd it to be a Dew or Moiſture that ſweated out of the Branches and Leaves of a kind of Aſh. When one is once got into the right Way, one goes far in a little Time. We have ſince diſcover'd ſuch a great number of Plants that tranſpire Juices like the *Manna* of *Calabria*, that Monſieur *Tournefort* has caſt them into four different Claſſes. Firſt, Such as contain a great deal of the Eſſential Salt of Plants; as common *Sugar*, the *Manna* of *Calabria*, that of *Brianſon*, &c. Secondly, *Roſius*, as thoſe of the *Pine-tree*. Thirdly, *Gums*, for inſtance, *Gum-Arabick*. And Fourthly and Laſtly, the *Gum-Roſins*. We know that the difference between Roſins and Gums is, that the Roſins are more ſulphurious, and the Gums more watry; ſo that the former are diſſolved in Spirit of Wine, and the latter in Water. The Gum-Roſins are diſſolved partly in Spirit of Wine, and partly in Water.

It may happen ſometimes that Plants grow weak and periſh at laſt by a too great Tranſpiration of their nouriſhing Juice, as Animals by two frequent and too abundant Sweatings. It is thus, according to Monſ. *Reneaume*'s Obſervation, that the *Nut-trees* in *Dauphiny* commonly die, after they are over-charged with a kind of *Manna* which they yield; and for that reaſon, the People of the Country are afraid of ſeeing it come out in too great a

Quantity. Not, but that that Tree has a great deal of the nouriſhing Juice; Monſ. *Reneaume* proves it by a remarkable Fact; but both the cloſe Texture of its Bark and Leaves, and the great Quantity of a very fleſhy Fruit which it is to feed, ſeem to demonſtrate that Nature did not intend that much of its Sap ſhould be ſo unprofitably ſpent by Tranſpiration.

There is another Way by which Plants loſe their nouriſhing Juice, at leaſt with reſpect to us and our uſes: It is by diverting it into young Branches, in Moſs at the Roots of Plants, in uſeleſs Branches, or in ſo great a Quantity of Fruits, that in a few Years they are exhauſted and bear no more. The Art of Agriculture has found the Remedies or the neceſſary Precautions againſt it. It is to prevent both theſe Evils at once that they cut the Vines.

It has been already obſerved, and Monſ. *Reneaume* confirms the ſame, that the Root is the Stomach of the Plant, and makes the firſt and chief Preparation of the Juice; from thence it paſſes, at leaſt for the greateſt part, into the Veſſels of the Bark, and there receives a new Digeſtion. The hollow and rotten Trees, whoſe Trunk has no more Wood in it than what is juſt ſufficient to ſupport the Bark, and which yet live and produce, do ſufficiently prove how much more important the Bark is than the woody Parts: The Leaves contribute to the Perfection of the nouriſhing Juice, as we ſee by the Trees whoſe Leaves have been eaten by Caterpillars, and which, tho' they had bloſſomed, bore no Fruit the ſame Year, or none but wither'd. The Action of the Air, or of the

Nitre of the Air, or of the Dew upon the Leaves is very ſenſible, by the Difference of the Colour and Taſt that is between Plants growing in the Air, and thoſe that are not ſo.

Such are the Principles of which Monſ. *Reneaume* makes more particular Applications in his Diſcourſe. *The Detail of Agriculture is of it ſelf very agreeable, and as all Mankind was naturally deſigned to that Employment, it ſeems that thoſe who have not the Practical part, ought at leaſt to Study the Theory thereof with much pleaſure.*

Upon THUNDER.

THere are Chymical Operations performed in the Air as well as in our Laboratories, and ſometimes they are the ſame. *Thunder* is nothing but that Inflammation of which we have ſpoken in the Hiſtory of 1701, occaſion'd by the mixture of a Sulphurious Matter with an Acid Spirit; but the Conformity even of theſe two Phenomenons may cauſe a Difficulty.

The two proper Matters mix'd together by a Chymiſt, when they are once inflamed, are entirely diſſipated, and there cannot be a new Inflammation without new Matter. But we often ſee a great Number of Lightnings one after another proceeding out of the ſame Cloud, which denote as many different Inflammations; but how comes it to paſs that when the inflamable Matter in the Cloud is kindled, there happen new Inflammations?

Monſ. *Homberg* thinks that the ſame Matters which take fire by their Union, and thereupon are immediately ſeparated, may be joined again and re-inflamed, and that it may ſo happen ſeveral times after one another. But that it cannot be ſo upon the Earth, becauſe as ſoon as they are kindled, and conſequently very much rarified, the lower Air more heavy than they, preſſing upon them from all Parts, raiſes them up into another Region, where they find themſelves in an Equilibrium with a finer Air, and ſo are quite loſt as to us. But if theſe ſame Matters are raiſed in Vapours from the Body of the Earth by the Action of Heat, they are arrived at that Region of the Equilibrium, where they are kindled, and meeting with no Air more heavy than themſelves, which after their Inflammation might cauſe them to aſcend, they are not diſperſed at all, but remain where they were, and may be joined again, till a Shower of Rain beats them down upon the Earth, and cleanſes the Air of them.

This Solution is ſo much the more probable, as it is founded upon the ſelf-ſame Operation by which Thunder is repreſented. If inſtead of pouring Spirit of Nitre as quick as you can upon eſſential Oil, which produces a ſudden Inflammation, one pours it drop by drop, there is only produced an Effervеſcence without Inflammation, and the mixture of the two Liquors becomes a Roſin, which being put into a Glaſs, and diſtill'd by degrees, renders the Acid and the Oil, of which it was formed. This Acid and Oil are ſtill capable either to be inflamed by their Union, or of producing a new Roſin, which will undergo the ſame Operation as often as you pleaſe. The Fire of the Diſtillation does here make the ſame Separation of the Matters as the Flame would have done, if you had ſuffer'd them to kindle; and conſequently it appears, that if they did not eſcape us, they might as well produce a new Flame as a new Roſin by their Reunion.

As at every inſtant, when a Flaſh of Lightning ſtrikes our Eyes, there is a pretty large Quantity of Matter inflamed, it may happen according to Monſ. *Homberg*, that all theſe repeated Inflammations may give a certain determination of motion to the Air, and produce ſome of the variable Winds that ariſe indifferently from all the Points of the Horizon, and are the only ones we know in our Temperate Climates.

From thence it is perhaps that we have more South thon North Winds, there being always much Thunder between the Tropicks. This is certain, that this Notion does pretty well explain why our Winds blow by ſnatches, the Lightnings follow one another pretty cloſe, and each makes a diſtinct Effort. If we were ſure that the Trade-winds blew more continued, it would be a Confirmation of this Hypotheſis.

Upon

Upon a WORM that came out of the NOSE.

A Woman of a very good Conſtitution, and who never knew what it was to have the Head-ach, about the Age of 36 began to feel a ſettled Pain at the lower-part of her Forehead, on the right ſide near the Noſe: This Pain, which at firſt took up but a ſmall ſpace, extended it ſelf by little and little as far as the Temples on the ſame ſide; and whereas at firſt it had great Intermiſſions, at the end of two Years, it became almoſt Continual, being attended with Convulſions, and almoſt perpetual Wakings; and at laſt it was ſo violent that the Patient was 2 or 3 times at Death's Door, and quite deprived of Senſe in the great Fits. At the end of four Years, and after having try'd all ſorts of Remedies in vain, ſhe left them off, contenting her ſelf with a regular Courſe of Life, and taking Snuff by the Noſe, which ſhe hoped would give her ſome Eaſe.

She had not uſed it above a Month, when one Morning, ſneezing pretty ſtrongly, ſhe voided by her Noſe a Worm, rolled up in a Ball, together with a little Blood: She was very much frighted at it, and cured the ſame Moment. At once ſhe perceived that long and cruel Pain to ceaſe, and the only Token that remained of it was, her Noſe bled for 2 or 3 Days together. Her Mind was likewiſe as free as it had been before her Illneſs. Monſ. *Littres*, to whom we are beholden for this Account, took care to be exactly informed of all theſe Facts as well as of the following.

The Worm was alive, and was ſix Inches long when he ſtretched himſelf out as long as he could, and but only two when he folded himſelf up *en zig-zag*, or in the Figure in which the Soldiers make Trenches before a Town they Beſiege, which was his moſt uſual Figure: He was two Lines in breadth, and one and a half in thickneſs in the biggeſt part of his Body, which was towards the Middle: His Colour was of clear Coffee; he was convex above and flat below, cover'd throughout, except at the Head, with annulary or ringy Scales of the largeneſs of a Line, and all of them ſeparated from each other by little Intervals, from each of which there came out as well on the right as on the left ſide 56 Legs of the length of a Line, and of the bigneſs of a Hair of one's Head: By which it appears, that this Worm was of the Kind of thoſe we call *Centipedes*. The Head was of about the Length of two Lines; one might eaſily diſtinguiſh in it two Eyes, two Horns, a Pincher made of two Branches that were more remote from each other at the Root than towards their Extremity, and a Mouth between theſe two Branches; the Tail was armed with two kinds of equal Stings longer and bigger than the Legs; it was put into a little empty Glaſs Bottle, where it was found alive 18 Hours afterwards; then they poured ſome Brandy upon it, notwithſtanding which it ſtill lived 2 or 3 Hours.

The Seat of the fixed Pain which the Woman felt, ſufficiently denotes that the Worm muſt have been in a Cavity called *Sinus Frontalis*, which is in the *Os Coronale* under the Eye-brow; that Cavity is about 2 Inches long, and between 8 and 10

Lines in Breadth, and conſequently able to contain the Animal as it was rolled up. It ſeems by the inclination he had to reſume ſuch a Figure that he muſt have been accuſtomed to it.

There is between the *Sinus Frontalis* and the Noſtril a Hole of Communication, by which the ſaid *Sinus* receives Air every moment one reſpires, and a ſtrong Reſpiration might have ſuckt in with the Air the inviſible Egg in which this Worm was incloſed: The ſame Egg might likewiſe have enter'd by the Mouth with ſome Food, and followed the long and winding Road of the Circulation of the Blood; but however, it is certain that the Animal could come out no other way but by the Paſſage before-mentioned. It is true the Diameter thereof was leſſer than that of the Body of the Animal; but as this Hole is immediately formed by a Membrane, he might dilate it by little and little, when he attempted to get out, and the drops of Blood that followed do even ſhew that he tore it a little.

The Egg had found in the *Sinus Frontalis* the Heat, Moiſture, Limphæ, in a word, every thing that was neceſſary for Hatching it; and the Animal every thing he wanted for his Subſtance, and for ſuch an Increaſe to which probably he would not have attained if he had been upon the Earth, where he would neither have been ſo well fed, nor ſecured from abundance of Accidents, which hardly allow four Years Life to all theſe ſorts of Worms. At every motion it made, it muſt have occaſioned, in the delicate Membrane that lines the *Sinus Frontalis*, an Irritation ſo much the more dreadful, as with his 2 Horns, and his 2

Stings, and his 112 Legs, it ſhook, and, as I may ſay, aſſaulted in particular each little nervous Fibre of the Membrane; and the ſtronger and bigger the the Worm grew, the more violent and inſupportable muſt have been the Pain. The bigneſs of the Animal, which made his Lodging ſo inconvenient for him, and probably too the ſmell of the Snuff, which was diſagreeable to him, as it is to a great number of other Inſects, made him ſeek for Means of getting out.

The Symptoms which the Patient had, might pretty eaſily cauſe the like Accident to be diſcover'd, in which caſe, Monſieur *Littre* is of opinion, that the Inflammation of the Membrane abovemention'd muſt be forthwith prevented by the ordinary Means that are uſed in Inflammations; the next thing to be done is to come at the Worm, which one may do both by the Internal Medicines that are uſed againſt Worms, and at the ſame time by External Remedies, ſince the Worm was within their reach too. One may already preſume that Tobacco is good, but beſides that, People may ſtrongly draw in at the Noſe ſharp or acid Juices, ſuch as may be found moſt capable of diſturbing the Animal. Monſieur *Littre* believes that nothing would ſooner kill it than Oil, becauſe that is known to deprive Inſects of Reſpiration, by ſtopping all the Orifices of their *Trachea*'s.

Laſtly, If none of theſe ways ſucceed one muſt come to a Chirurgical Operation, which he aſſures us would neither be dangerous nor difficult upon the *Os Coronale*. *What Diſorders does an Atome cauſe in the Machine of the Humane Body! even to the overturning of our Reaſon it ſelf.*

Upon the Cures made by BURNINGS.

HEre is another inſtance of violent Head-achs, which have been as ſuddenly and unexpectedly cured. A Lady of 35 Years, and of a good Conſtitution, was troubled with continual Head-achs, with Redoublements that ſeized her regularly one in 8 or 10 Days, and laſted 10 or 12 Hours at a time, ſo violently, that ſhe was ſometimes quite ſtupified with them, and ſometimes raving Mad. The Seat of the Pain was chiefly in the fore-part of the Head, and in the Eyes, which thereupon became very red, and ſparkling. The great Fits were attended with Retchings, and always ended in Vomiting abundance of a white inſipid Matter, and a green and very bitter Water, which came laſt of all. At thoſe times ſhe could take no kind of Food, otherwiſe her Stomach was very good, nor did ſhe grow Lean, notwithſtanding the long continuance of ſo uneaſy a Condition.

Monſieur *Homberg* made uſe of all ſort of Remedies for the ſpace of three Years, but in vain. Opium alone did for ſome Hours ſuſpend the ordinary Pains of her Head, but had no effect upon the Redoublements.

One Evening when ſhe felt one of thoſe Fits coming upon her as ſhe was going to Bed, ſhe had a mind to ſee firſt whether her Eyes were very red, and whilſt ſhe looked in a little Pocket Claſs, a Wax-Candle that ſhe held in her Hand fired her

Night-Cloaths that were of thick Muſlin; ſhe did not perceive it immediately, and happen'd to be all alone. She burnt all her Forehead, and part of the Top of her Head before any Body could come to her Aſſiſtance. Monſieur *Homberg*, who was preſently ſent for, cauſed her to be Blooded that inſtant, and the Burn to be dreſſed as in like Caſes, the Pain whereof was ſtopp'd in a few Hours, but the great Fit, which ſhe expected, came not at all; even the ordinary Pain diſappeared almoſt immediately after, without any other Remedy than the Burn; and for theſe four Years, ſince that happy Accident befel her, the Lady enjoys perfect Health.

A Phyſician of *Bruges* has communicated to Monſieur *Homberg* a like Account, of which he himſelf was Witneſs. A Woman, who for ſeveral Years had had extraordinary Swellings and Pains in her Legs, found Eaſe by Bathing them with Brandy every Morning and Evening by a Fire; one time the Fire by chance got hold of the Brandy with which ſhe had rubbed her ſelf, and burnt her ſlightly. She applyed ſome Ointment to the Burn, and during the Night all the Waters with which her Legs and Thighs had been extreamly ſwelled, were entirely evacuated by Urine, and the Swelling returned no more. *What pity it is that ſuch Accidents do not oftner intervene in the Practice of Phyſick?*

'Twas Chance, without doubt, that has taught this kind of Remedy to ſeveral barbarous Nations that uſe it with Succeſs, and perhaps more chearfully as it is more Cruel, and affords them more Occaſions of ſhewing their Courage.

Monſieur *Homberg*, who was Born in the Iſland of *Java*, remembers that when the People of that Country are troubled with a certain Cholic, or with Belly-achs, and Fluxes that are uſually mortal, they cure themſelves by Burning the Soles of their Feet with a hot Iron. If they have a *Panaris* on their Fingers, they dip the Finger that is affected in boiling Water ſeveral times, an Inſtant at each time; and Monſieur *Homberg* himſelf, to follow in ſomething the Cuſtom of his Country, was cured of a *Panaris* after the ſame manner. In the Relations of Travellers, we find a great many other Diſtempers, which the Savages cure by Burnings; and without going ſo far, we our ſelves upon many occaſions apply the like Remedy to *Horſes*, *Hunting-Dogs*, *Birds of Prey*, &c. But it is likewiſe true, that our own Niceneſs and Tenderneſs does not ſuffer us to uſe it upon our ſelves, and makes us perhaps prefer long Pains to ſhort ones.

The ſame Tenderneſs would not ſuffer us a long time to uſe in *Europe* that *Moxa* or *Moſs*, that the *Spaniards* brought from *America*, and wherewith they cured the Gout by Burning it upon the Part affected. However, Monſieur *Homberg* has ſeen an Inhabitant of *Hamburg*, who by this Remedy was delivered from his Fits of the Gout in 7 or 8 Days time, which before laſted 2 or 3 Months, and they returned much ſeldomer upon him afterwards.

Monſieur *Homberg* ſuppoſes that Burnings cure in three manners; either by putting the Noxious Humours into a very rapid Motion, which makes them find out new Ways; or by rendring them Fluid that before were Viſcous, which comes to

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the ſame effect; or, laſtly, by deſtroying part of the Veſſels which brought them in too great an abundance.

Upon the Generation of SNAILS.

THE Philoſophers that are reproached of Studying with too much Care and Application the Nature of ſuch contemptible Animals as Inſects, may defend themſelves by only asking this Queſtion: Whether the ſmalleſt Works that come out of the Hands of God deſerve to be neglected? But theſe ſame Works which the Common ſort of Mankind are pleaſed to look upon as the ſmalleſt, are even thoſe in which we diſcover the greateſt Wonders of Mechaniſm; and if we henceforwards prefer the Enquiries made into the Anatomy of Humane Bodies, it is our Intereſt alone that can bear us out in doing it.

If one examines externally a *Brown Snail* of the Gardens out of the time of its Copulation, and if one diſects it with all the Care imaginable, one ſhall not find in it any part that ſeems to belong to Generation. Neverthleſs, as we have already ſaid in the Hiſtory of 1699, this Animal is an Hermaphrodite, and has conſequently, with relation to Engendring, a greater *Apparatus* of Organs than a vaſt number of other Animals, more known and more ſtudied. Every thing that happens to him upon this occaſion, muſt likewiſe be of a very particular Nature. We ſhall here give an Account of the Chief of theſe Singularities, without undertaking in any manner to explain by what Mechaniſm they are performed. This Explanation would be uſeleſs, if any of the Circumſtances ſhould be omitted that are in the Diſſertation of Monſieur *du Verney*, which the Author's Sickneſs has hitherto hinder'd from appearing. *One can hardly ſee without Amazement, to what an expence Nature is put in the Formation of this contemptible Animal.*

This kind of Snail has on the right ſide of the Neck a little Cleft or Hole, almoſt impercepible, which only leads to little Conduits or Cavities, and a ſort of very winding Inteſtines floating in its Belly: At the time of Coition all that changes it Form, and the Animal becomes almoſt metamorphoſed. Theſe Inteſtines are then thruſt from the bottom of the Belly towards the Neck, where they ſwell, and are turned and winded, and finally diſpoſed and ranged among themſelves in ſuch a manner, to approach the Cleft of the Neck, which is then very much dilated under the Figure of a Male and Female Part, each of them ready to perform their Functions; that does not wholly happen till after that one Snail has met another, and by ſeveral Preliminary Motions more brisk, and, as one may ſay, more paſſionate than one ſhould expect in ſuch a Cold Species of Creatures, they have put each other into the ſame Diſpoſition, and have ſecured a perfect Agreement.

They have likewiſe another very ſingular way of arriving at their Ends with more Certainty, and they never fail to put it in Practice. Together with the Male and Famale Part there comes out likewiſe by the Hole above-mentioned, a kind of a Sting like a Lance with 4 Beards, and ending in a very ſharp and hard Point. As the Snails turn towards each other the Hole or Cleft of their Neck, it happens that when they are touched in that Part, the Stings prick each other, and the Mechaniſm that puts this little Dart in Motion, is ſuch, that it abandons at the ſame time the Part to which it is faſtened; ſo that the ſaid Sting either falls to the Ground, or the Snail that is pricked carries it away. Then the Snail immediately retires, but preſently after he rejoyns the other, and pricks him in his turn; and after this Reciprocal Wounding, the Coition never fails to be accompliſhed; whereas all the other Preludes may be without Conſequence. The Sting bearded on both ſides, ſeems to be deſigned to give notice to both the Snails that they are equally ready; for in this Hermaphroditical Species there is not, as in ours, one Principal and more active Sex, whoſe Diſpoſition alone is ſufficient.

The Snails are wont to couple even 3 times, the ſpace of 15 Days being interpoſed between each time. At each Coition one ſees a new Sting, and Nature is at the Pains of producing them for a uſe ſo little important in Appearance. Monſ. *du Verney* compares this Regeneration with that of the Horns of Stags, and really, the Proportions being obſerved, theſe Stings ſeem to be of a like kind of Subſtance.

After the Lanced Sting, follows the Reciprocal Inſertion of the Male-part of each Snail; and as they have both the two Organs of Generation diſpoſed in the ſame manner at the Cleft of the Neck, it will be neceſſary, to the end that each Organ anſwer to that which does not reſemble it, that one of the Snails hold its Head upwards, and the other down, which they know very well how to put in Practice.

Their Coition laſts 10 or 12 Hours: It produces in them, eſpecially when it begins, either a Stupifaction or a Tranſport that hinders 'em from giving any Sign of Life. They will not part from each other, do what you can, and they have a very good reaſon for it, which is, the Gland of the Male-part ſwells to ſuch a degree, that it can't come out again by the part it enter'd. It is perhaps an Hour in acquiring this Extenſion, which it does *Gradatim* but till it attain'd to it, no ſeminal Matter is ejected.

Nay, ſuch Matter is not ſo much as form'd till then, and it is not till after the Coition is begun, that Nature thinks, as I may ſay, of preparing it, and that ſhe ſets thoſe Parts at Work that are to provide it. This Matter has yet another Particularity very remarkable, it is not *Liquid*, but of the Conſiſtence of Wax, and puts on the Figure of the Veſſels thro' which it paſſes; it is protracted by a Motion like that of the Inteſtines, when they throw out that which is contained in them. During the whole time of Coition, except the firſt Hour, this Matter paſſes ſlowly on both ſides from one Snail to the other.

It comes out of Channels longer than the Veſſel of the Female-Part, where it is immediately receiv'd, and for that reaſon it is forced to double it ſelf; from thence it paſſes into other Veſſels of the Female Sex, where it finally cauſes Fœcundity, tho' not immediately after the firſt or ſecond Coition, but only after the third.

At the end of 18 Days the Snails lay their Eggs by the Cleft or Orifice of their Neck, which they hide in the Ground with great Care and Pains; but there is yet another very ſingular thing, which is, if you Diſſect a Snail a little while before ſhe lays, you meet with no Eggs, but only with little Embrio's ſwimming in a very clear Liquor, and moving very briskly. Theſe Embrio's become Eggs in the way of their coming out, that is to ſay, they are cloath'd with Membranes, which certain Liquors ſupply them with, and then grow hard.

All this is only the Natural Hiſtory of the Generation of Snails; 'tis what is done, but not the manner of doing; and if one leaves this manner to the Conjecture of the moſt skilful Philoſophers, it would aſſuredly be a very difficult Riddle to them. It is even ſtill almoſt inſcrutible, tho' we have all the Parts of this Mechaniſm in our Hands, tho' we ſee with our Eyes how it is perform'd, and it is one of the greateſt Efforts of Humane Sagacity and Underdanding to comprehend the whole Operation thereof.

Upon the Weight of the ATMOSPHERE.

THE *Weight* of the *Atmoſphere* is of ſuch Importance in Philoſophy, that it cannot be too much ſtudied; we are even invited to it by the hope of the Succeſs which ſeems only to depend upon ſome pretty eaſie Calculations.

Monſieur *de la Hire* having made at *Meudou* ſome very nice Experiments, how much the heighth of the Barometer differ'd from the higheſt Part of the Park down to the River, which is 85 and $\frac{1}{3}$ Fathoms at the Bottom, he deducted from it the Heighth of the Column of Air, which was then equal to one Line of the Mercury, and counter-ballanced it, and found that it was very near 76 Foot; the Weight of the whole Column of the Atmoſphere being 28 Inches of Mercury within half a Line. He made uſe of a very good double Barometer of Monſieur *Huygens*, which ſhews the Degrees of the Variation in a much greater Extent than the ſingle Barometer; but it likewiſe requires more Calculating, becauſe it muſt be reduced to the Single, and he reduced it thereto according to the Principles we have explained after him in the Hiſtory of 1708.

It is neceſſary to obſerve, that the whole Heighth of the 85 and $\frac{1}{3}$ Fathoms were pretty near equal to 7 Lines of Mercury, and that the 76 Feet of the Heighth of the Air, which anſwer to one Line of Mercury, were found, by ſuppoſing the 7 Heighths of Air, each of which anſwer one Line of Mercury, to be equal among themſelves, which is not exactly true; for the lower is the leſſer, becauſe it is loaden with a greater Weight, and is more condenſed, and ſo of the reſt; but Monſieur *de la Hire* has ſlighted this Difference: Meſſieurs *Caſſini* and *Maraldi*, having a regard to it, have placed between theſe Heighths a Progreſſion, ſo that the firſt having 61 Feet, the ſecond had 62, the third 63, *&c.* at leaſt in the Extent of half a League; after this, reckoning the middle Heighth of theſe 7 Diviſions would be 64 Feet, which is a great way off of 76. We muſt not conceal theſe Differences, which perhaps may be accommodated in time.

With his Obſervations upon the Weight of the Atmoſphere, Monſieur *de la Hire* has joyned others, concerning the Variation that Heat and Cold produce in the Liquor of the double Barometer, a Deceitful Variation, and which, if it were not well known, might be attributed to the Alteration of the Weight of the Air. He ſuppoſes, as it is true, that the Mercury in the ſingle Barometer is not ſenſibly rarified nor condenſed either by Heat or Cold; he compared it every Day for three Years together with a double Barometer, and afterwards took the moſt differing Days with reſpect to Heat and Cold, in which, however, the ſingle Barometer was at the ſame Heighth: It is plain, that on thoſe Days the heighth of the double Barometer ought to have been the ſame, if it did not vary but with the weight of the Atmoſphere: But it was always different, and ſometimes 19 Lines, which this Barometer was higher in the Heat. It happen'd in thoſe three Years of Obſervation, that there were no great

Colds but only great Heats. Beſides, there were not Days of greater Heat and of greater Cold, on which the ſingle Barometer was of the ſame Heighth; ſo the 19 Lines are the Dfference only between a great Heat and a temperate Air; and Monſieur *de la Hire* could not ſee the greateſt Variation of which the double Barometer was ſuſceptible in that reſpect. It ought much to exceed 19 Lines, which certainly is not to be reckon'd for nothing. Neverthleſs the Liquor of this Barometer was choſen for the leaſt capable of Rarefaction as could be.

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Upon the Matter, or Subſtance of FIRE.

THE Hiſtory of the Academy for the Year 1700, ſpeaking of Lime, ſays; *We cannot ſuppoſe its Active Principles to be any other thing but Particles of Fire, which the Calcination has introduced into the Lime. It is true, that theſe Igneous Particles being become fixed and immoveable in the Pores of a Body, do a little ſhock the Underſtanding; but however, the Regulus of Antimony Calcined by the Burning-Glaſs does actually increaſe in Weight, and one cannot ſuſpect any other Subſtance to have been mixed with it, but that of which the Rays of the Sun are compoſed. It muſt be confeſſed that this Hypotheſis is equally difficult to be admitted or rejected.*

Monſ.

Monſieur *Lemery* the Son, is of an Opinion that one need not remain under this Uncertainty, and abſolutely declares for the above Hypotheſis. It has been believed hitherto that the Eſſence of the *Matter of Fire* conſiſts only in a great Subtility, joyned to an extream Agitation, and, according to that Notion, it is impoſſible to conceive that when it is ſhut up in the Pores of Lime, or *Regulus of Antimony*, or in ſhort, of any other Mineral, whoſe Weight is augmented by Calcination, it ſhould not loſe all its Motion, and ceaſe to be what it was before, the Matter and Subſtance of Fire. But Monſieur *Lemery* adds to its Subtility and Agitation a peculiar Figure, ſo that, neither another Subſtance, tho' it had as much or more Subtility and Agitation, could be the Matter of Fire, nor the other ceaſe to be ſo; or it would at leaſt be altogether diſpoſed to become Fire again, tho' it might have loſt part of its Motion. It is true, it muſt not loſe it altogether; and in order to preſerve as much Motion as is neceſſary for it, one may conceive that it both acts and always ſtrives to force its way out of the little Cavities of the Bodies in which it is impriſon'd; and alſo that another Matter, much more ſubtile or fine and more agitated, which fills all the void Spaces of the Univerſe, and finds no Pores ſo narrow as not to allow it a free Paſſage, does inceſſantly flow into thoſe Places where the Subſtance of Fire is ſhut up, and maintains its Activity and Motion: It has not indeed ſufficient to force its Priſons, but is always in a Condition to joyn its own Strength to that of ſome External Agent coming to its Aſſiſtance. Thus it is, that when one pours Water upon Lime, whereby its Parts are opened and ſeparated, the Matter of Fire incloſed therein breaks out on all Sides, and cauſes a violent Effervеſcence.

If it ſhould be asked, why this Matter, which, Calcination has introduced into the Pores of a Body, does not afterwards come out by the ſame? Monſ. *Lemery* anſwers, that the Action of the Fire rarifying all Bodies, as is known by Experience, it makes, as long as it laſts, their Pores much bigger; and when it ceaſes, it ſuffers them to be contracted again, and conſequently to impriſon in in its little Cavities all that had penetrated into them.

There is nothing alone, or ſingular in Nature, and if a certain Mechaniſm be conſtant and uniform upon certain Occaſions, it will likewiſe be found to be the ſame upon other Occaſions that may be analogous to them. Since therefore it is once admitted that Fire can, without ceaſing to be what it was before, ſhut it ſelf up in the Cavities of Calcined Bodies; we have a right to ſuppoſe that it may have been in like manner ſhut up in the Cavities of ſeveral other Bodies, as ſoon as we ſee that it comes out of them; and in a word, one may lawfully ſuppoſe that it is that ſame Subſtance that renders inflameable all Bodies that are ſo, and that it eſcapes under the form of Flame as ſoon as it can diſentangle it ſelf, eſpecially if there be but enough of it. The Sequel of Monſieur *Lemery*'s Syſtem extends it infinitely.

At this reckoning the Subſtance of Fire and that of Water, tho' ſo very oppoſite, have an eſſential Relation; both the one and the other of 'em being hid under an Infinity of Mixtures, and oftentimes even in great Abundance, nevertheleſs without diſcovering therein any of their moſt ſenſible Properties, and without declaring themſelves for what they are, unleſs ſome external Agents aſſiſt in the exerting them.

The *Phoſphores* are thoſe of all the Bodies in which the Matter of Fire is moſt viſibly incloſed: One need only expoſe them to the Light, and they preſently receive ſome new Matter that puts the Old into Action: We may call 'em *the Sponges of Light*, becauſe it is ſqueezed out of 'em with the ſame Facility as it is taken in. You muſt conceive all inflameable Bodies to be like *Phoſphores*, only leſs ſenſible, and not ſo readily reſtoring that Subſtance of Fire which is contained in them.

The Air likewiſe may be eſteemed a great *Phoſphore*, all impregnated with the ſame Matter, and only waiting for the Action of the Sun from whence it is derived. But we will not carry any farther Notions that ſhould belong to a general Syſtem; we refer to Monſieur *Lemery*'s Diſſertation, who muſt likewiſe be accountable for all thoſe Difficulties, which general Syſtems never fail to abound with.

Upon CRABS-EYES, *&c.*

WHat they call *Crabs-Eyes*, are little white Stones, round, and commonly flat; and they are ſo called, becauſe they are really taken out of Crabs and Craw-fiſhes; and tho' they are not at all like Eyes, yet they are more like them than any other Part. The moſt Learned Naturaliſts believed they were formed in the Brain of Craw-fiſhes, and *Van Helmont* firſt diſcover'd them to be in the Region of the Stomach; beſides ſeveral other very remarkable Particularities of the Natural Hiſtory of theſe Creatures. But as there is not much Credit due to him, what he ſays, has not been much minded; nevertheleſs, Monſ. *Geoffroy* the Younger, has verified a great part of it, in a Diſcourſe of which the following Account is an Abſtract.

There are a ſort of Animals that wear their Bones on the out-ſide, whereas others wear theirs within; of the firſt ſort are the Craw-fiſhes, which every Year, about the Month of *June*, caſt thoſe Bones, which are both their Coat and Armour. A Membrane that lines the inſide of their Shells ſupplies the place, and by growing hard and thick becomes a new Shell. At the Time of this Molting, that Fiſh is weak and languiſhing, and not good to eat.

The Reptils or creeping Creatures that ſhed their old Skin, are an Example of that which happens to the Craw-fiſhes; and in ſhort it is no ſuch ſtrange

Thing that an Animal ſhould be diveſted of its external Covering. *But it is very amazing that an Animal can quit or deprive it ſelf of an internal Part, ſuch as the Stomach :* And yet this is the Caſe of the Craw-fiſhes. Their old Stomach diſappears, and probably the Inteſtine alſo ; at leaſt Monſ. *Geoffroy* is of that Opinion, and that the external Membranes of thoſe Bowels ſucceeded. There is reaſon to believe, that as they are worn out and half diſſolved, the total Diſſolution of 'em is performed in the new Bowels, and they are converted into the Nouriſhment of the Animal, during its Molting and Sickneſs. *Thus the old Stomach is the firſt Food that the new one digeſts.*

'Tis only at this Time that are found the Stones they call *Crabs-Eyes* ; they begin to be formed when the Old Stomach is deſtroyed, and are afterwards folded up in the New, where they always diminiſh in bigneſs, till at laſt they quite diſappear. Monſ. *Geoffroy* is of opinion, that they likewiſe contribute to the Nouriſhment of the Animal during its Sickneſs. *What a prodigious Diverſity of Deſigns in the Works of Nature ! Who could have thought that there is an Animal which feeds upon the ſubſtance of its own Stomach ? After this, if there be any thing incredible in this Kind, it muſt be an Impoſſibility well Demonſtrated.*

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Upon the Formation of SHELLS.

HItherto the Curious have been chiefly concern'd with Shells; that is to ſay, with their prodigious Variety, exact Regularity of their Structure, Beauty, ſingular Vivacity of their Colours, and Juſtneſs of their Compartments, ſcarce imitable by the beſt Pencil; but the Philoſophers have not done them, as I may ſay, all the Right they ought, and have too much neglected to conſider them as Naturaliſts, and to Study their Formation; probably they believed that ſince the Shells of Snails, *&c.* as well as the Armour of Crabs and Lobſters, are external Bones to all the Animals they cover, they ought to be look'd upon as part of their Bodies, and that this wonderful Structure is included in that of the general Formation of Animals, not to be comprehended by the Mind of Man; they have therefore ſuppoſed that the Animal and its Shell ſprang from the ſame Egg, and were unfolded together; and they contented themſelves with wondering that Nature had beſtowed upon 'em Houſes ſo well built, and oftentimes ſo precious for ſuch baſe Creatures. But this Suppoſition is only convenient, and tho' probable enough, is by no means true. The Animal proceeds from its Egg, but not the Shell, which is a diſtinct Miracle, and Monſieur *Reaumur* is the firſt that has unravelled it; at leaſt we know not hitherto any other Author that can diſpute with him the Glory of this Diſcovery.

He

He has found out, by deciſive Experiences, that the Shell of Garden-Snails is formed of the Matter tranſpired from their Bodies, and afterwards harden'd by the Air. It is certain that all the other Animals do likewiſe tranſpire, and are ſurrounded with a kind of Miſt or Atmoſphere, which is exhaled from them, and which perhaps does pretty near aſſume their external Figure. All that the Snails have in particular is, that the Atmoſphere of their Tranſpiration is condenſed about them, and forms a viſible Covering of which their Body is the Mold; whereas what other Animals perſpire, evaporates, and is loſt in the Air. This difference proceeds from the different Subſtance tranſpired, that which comes out of the Snails is viſcous and ſtony. This is not a bare Suppoſition; it is a Fact ſufficiently proved by Monſ. *Reaumur*'s own Experience.

At this Reckoning, tho' the Shell performs the Office of an Univerſal Bone to the Animal; yet it does not grow like the Bones, nor as other Parts by Vegetation, that is to ſay by a Juice that circulates within it; but only by an External addition of Parts that come over one another, after the ſame manner as Stones are thought to grow; and it is remarkable that there are a kind of Animals that borrow from Minerals this way of Augmention.

To enter a little farther into the detail of the Matter, it muſt be remember'd that the Head of the Snail is always at the Orifice or opening of the Shell; and that its Tail, or the other extream part of its Body, lies towards the point or top of the Shell; and that its Body from what Cauſe ſoever it proceeds is naturally of a Spiral Figure, of which the different Turns are in different Planes. This being ſuppoſed, Let us take a Snail that is juſt hatched, and is as ſmall as can be: Since the Matter which it tranſpires is petrified about it, there will be made at firſt a little Caſe proportion'd to the ſize of its Body; and whereas its Body is as yet too ſmall to make a ſpiral Turn or at leaſt an entire Figure of that kind, this Caſe would only be the Center, or at moſt, the firſt beginning of an exceeding ſmall ſpiral Turn. Then the little Creature grows, but if it ſhould ceaſe to Tranſpire, it is plain that its Body, as far as it was enlarged, would remain naked; but as it never ceaſes to tranſpire, it makes it ſelf a Covering in Proportion as it grows; it puts it ſelf at the end of the firſt, and if it grows ſo far as to make a ſecond ſpiral Turn, the Shell likewiſe makes a ſecond. This ſecond Turn is the ſecond, or which is the ſame thing, the Spiral is extended in length, becauſe the Animal grows ſo too, and at the ſame time this Turn is likewiſe larger than the firſt, or of a greater Diameter, becauſe the Animal is likewiſe increaſed in bigneſs. The other Turns are formed after the ſame manner: They proceed in the Shells of Garden-Snails as far as four Turns and a half.

It is a neceſſary Conſequence of this Formation of the Shells, that the firſt Turns of that of a young Snail, which for inſtance, may have had yet but two, ſhould be no bigger than the two firſt Turns of a Shell of an older Snail which has four; for that which is once formed in the Shell does increaſe no more, only there is added in time a new Shell to it. And this is what is unchangeably obſerved; ſo that nothing more is required to demonſtrate Monſ. *Reaumur*'s Syſtem: And what ſtill confirms it is, that theſe firſt Spiral Turns, which in the Shell of a young Snail are as long and as large as in that of an older, are notwithſtanding leſs thick. We may ſee by that, that the Part of the Animal, which would have remained naked, by its growing bigger is, as it has been ſaid, that which has laboured to cover it ſelf; and that thoſe Parts which were already cover'd by continuing to tranſpire, do augment the thickneſs of their Covering.

Let us deſcend a little farther into the Particularities of this Creature. We ſee Spiral Rays traced upon the Shells of Snails, chiefly upon thoſe of a certain kind of little Garden-Snails; the Ground whereof is commonly Yellow, or Lemon-colour with black or dark Rays.

Monſ. *Reaumur* explains thoſe Rays after the following manner: That which is called the *Collar*, or Neck of the Snail, is the principal Worker of the Shell; becauſe when the Snail grows, the Collar always remains uncover'd. If you ſuppoſe it to be yellow, with one only black Spot, or to ſpeak more exactly, that the Matter that tranſpires from the whole Collar is of ſuch a Nature as to make the Shell yellow, excepting ſo much as comes out of one only Pore or Point, and which will make the Shell black; it is plain (provided you repreſent to your ſelf the Animal growing ever ſince its ſmalleſt Size, always turning it ſelf ſpirally, and augmenting the Number of Turns) that the black Point of the Collar will trace upon the whole Shell a black Ray, which will be a Spiral very exactly deſcribed according to the inſenſible and regular Growth of the Animal. If the black Point was not a Point, but a right Ray, the Spiral of the Shell would be leſs Curve, but it would always be regularly deſcribed. If there were upon the Collar ſeveral Points, or ſeveral Rays of the ſame or of different Colours, there would likewiſe be upon the Shell ſeveral Spiral Rays, either of different Colours, or of the ſame, and the Poſition they would have between themſelves would depend on that of the Points or Rays of the Collar.

It muſt not be thought that theſe Points or Rays of the Collar are a meer Suppoſition; they are diſtinctly ſeen; and beſides, they are always obſerved to be ranged under the Extremity of the Spiral, which they muſt have traced upon the Shell; the part of the Snail that comes next to the Collar yields nothing but a white and ſhining Matter; and as it is that, which as long as the Snail grows, ſucceeds the Collar, and always places it ſelf under the part of the Shell that it has formed, it tinges the whole internal Surface of the Shell with a ſhining white, and from thence it comes that the ſaid Surface either has not the ſame Colour as the External, or elſe has no variety of Colours.

There is no Naturaliſt that cannot of himſelf apply what has been here ſaid of the Shells of Snails to thoſe of all the other Animals that are ſo covered. The Varieties that we have already imagined in the Collar, with reſpect to the colour, number and poſition of its Points or Rays, may

help

help us to fancy a great many other of different Kinds. For inſtance, if there are little Eminencies diſpoſed upon the external Surface of the Animal, the like will be produced upon the Shell, which will always be regularly augmented in Proportion as the Collar and its Eminences increaſe. If the Animal ceaſes to grow at certain regulated Seaſons that are contrary to it, as in Winter or Summer, and afterwards begins again, it may have upon its Shell marks and traces of thoſe different Periods, as the concentrick Circles about the Bodies of Trees denote the different Growths of each Year interrupted at certain Seaſons. We ſhall omit a larger Detail, as well as all the particular Mechaniſm of the Formation of Shells. It is enough to diſcover in general, and to ſee how *ſome Animals are themſelves the Architects of their own Houſes, and that the Regularity of thoſe Houſes is owing to their concurrent Growth with the Architects themſelves, of whom they repreſent all the different Ages and Conditions.*

We cannot but obſerve here that whilſt Monſieur *Reaumur* ſtudied this Matter, Monſieur *de Verney* likewiſe applied himſelf to the ſame, as making part of the entire Hiſtory of Snails, which he has undertaken. In the Hiſtory of 1708, we have taken notice of his Diſcoveries about their Generation; he proceeds in accounting for every thing concerning this Creature even from its Egg. We ſhall ſee in time his Opinion about the Formation of their Shells.

Upon CACHOU.

AS the Naturaliſts don't well know what to make of thoſe little black Grains, the Subſtance of which comes from the *Indies*, and what we call *Cachou*, it is the Buſineſs of the Chymiſts to find it out. Monſieur *Boulduc* is perſwaded by all the Analyſes that he could make of it, that it is a Vegetable Juice. The Extract that is drawn from it by the Spirit of Wine, is both in a greater Quantity, and of a ſtronger Quality than that which is drawn by Water, a Sign that it is the Sulphur or Reſinous Parts that are Predominant in this Compound Body.

Upon the Analyſis of HOG-LICE.

THE *Hog-Lice* are an Inſect ſo well known that it would be needleſs to give a Deſcription of them; only it is good to obſerve, that Monſ. *Lemery* has certainly found out, contrary to the Opinion of ſome Authors, that they are Viviparous, or that they bring forth alive; he believes there are two Kinds of them, the Domeſtick, that are found in Cellars, in the Crevaces of Walls, in ſhort, in all moiſt and ſalt-petrous Places; and the Wild, that live in Corn-Fields and Woods, and in the Clefts of old Trees.

This

This latter Sort are the ſmalleſt, and are leaſt made uſe of in Phyſick. The Domeſtick are preferable, becauſe they ſeem to be more impregnated with Salt-petre, upon which they feed, and which gives them all their good Quality; for it is that Salt that is proper for opening and diſſolving, as in Pains of the *Kidney*, *Jaundice*, *Kings-Evil*, and *Squinzie*, &c.

Monſ. *Lemery* has drawn from the Domeſtick *Hog-Lice* by Diſtillation, a volatile Salt very like that of Vipers, and which may be uſed againſt the ſame Diſtempers and in the ſame Doſe. The Spirit of *Hog-Lice* has the ſame Vertue, ſince it is nothing but this volatile Salt that ſwims in a Phlegm. There comes from *Hog-Lice* as from Vipers, and more generally, as from all other Animals, a black and fœtid Oil, impregnated likewiſe with a volatile Salt: This having been mixed with twice as much Spirit of Nitre dephlegmated, there aroſe a great Effervescence, and Monſ. *Lemery* even thinks that he perceived a little Fire in it, but involved, and as it were abſorbed by the thickneſs and blackneſs of the Oil. This Experiment might reſemble the Inflammation produced by the mixture of Spirit of Nitre with the eſſential Oils of certain Plants; of which mention has been made in the Hiſtory of 1701, and it would depend on the ſame Principle; that is to ſay, the extream Greedineſs wherewith Sulphurs, throughly diveſted of their Acids, do imbibe it. There might only have been one difference which Monſ. *Lemery* has obſerved; it is that he does not ſuſpect any Alcali in the Eſſential Oils of Plants, whereas one may believe that there is ſome in the Oils of Animals, which have been drawn by the Retort over a great Fire; for it is very probable that it is the Fire which makes theſe Alcali's, and ſo there is nothing but the Experiment of the Oils of Plants that proves that theſe Alcali's are not the only Matters capable of producing an Efferveſcence with Acids.

The Coal that remains from the *Hog-Lice* diſtilled in the Retort having been calcined, Monſieur *Lemery* found Iron in the Aſhes thereof. He has likewiſe found it in the Aſhes of other Animals, but not always. He could draw none from Harts-horn, Ivory, Crabs-Eyes, or Oiſter-Shells; whereas hitherto it has always been found in the Aſhes of Vegetables. Perhaps by repeating the Experiments upon ſome Matters in which Iron is found, and upon others where it is not, one may in time diſcover the reaſon of the Difference.

Upon Vegetable and Mineral ACIDS.

WE have ſeen that the Sulphur which enters into the Compoſition of Metals, at leaſt of imperfect ones, is exactly the ſame with that in Plants, but upon the Experiments made and reported by Monſ. *Homberg*, one would think that the Mineral and Vegetable Acid were very different.

If you pour upon the Spirit of Urine, which is a volatile Alcali, about the like quantity of diſtilled Vinegar, which is a vegetable Acid, it will not produce either an Ebullition or Effervеſcence, and this Tranquility of the two Liquors mixed together will continue till either the Quantity of the Spirit of Urine be very much diminiſhed, or that of the diſtilled Vinegar very much augmented; but if upon the aforeſaid Spirit of Urine, let the Quantity be what it will, you pour a Mineral Acid, ſuch as the Spirit of Salt or Nitre, if there be but a Drop of it, immediately it cauſes an Ebullition more or leſs violent, as there is more or leſs of the Acid, with reſpect to the Quantity of the Alcali. Monſ. *Homberg* relates another Experiment of the like Nature, and which proves the ſame thing.

Nevertheleſs, he does not pretend that the Vegetable and Mineral Acids are different. From whence do Plants draw their Acids but from the Earth, and are they not Mineral there? But he ſuppoſes that theſe Acids, both in their own Nature, and when they enter into the Compoſition of ſome Mineral, are like Bundles of Needles laid upon one another; whereas, after they have been ſuck'd by the Roots of Plants, and circulated thro' their narrow Veſſels, the Needles are ſeparated, and thereby loſe that Strength which they had acquired by their Union. This Notion alone is ſufficient to account for the little Syſtem of Monſ. *Homberg* upon this matter.

How ſtrong ſoever the Mineral Acids may be when they lie in Bundles, they nevertheleſs meet with a great deal of Trouble, when they have to do (not with diſtilled volatile Alcali's, ſuch as the Spirit of Urine, which are in ſome manner naked, and entirely expoſed to their Action) but with other volatile Alcali's not diſtilled, that are yet involved and entangled with Oils or other foreign Parts. 'Tis thus that Monſ. *Homberg* ſays, *he has ſeen a Mixture of Spirit of Nitre and Cantharides, or Spaniſh-Flies, cauſe a little and ſlow Ebullition for above two Years together.* The occaſion of ſo remarkable a Fact, as it is mention'd in his Diſſertation, deſerves a particular Attention; it was about a Medicine for the Gravel and the Stone.

Monſ. *Homberg* in following the preſent Theory, has found out a Remedy for a Diſeaſe of much leſs Importance and Conſequence to any but the Ladies; it is againſt the *Tann* and *Freckles* in the Face; but thoſe Remedies, which are the Reſults of Reaſoning, ought to be the more valuable, were it only for their ſcarceneſs. He found by Experience that the Gall of an Ox was a Soap like an artificial Soap, that is to ſay, a Body compounded of an Oil and an Alcali. On the other ſide, he was of opinion, that the Freckles are an oily and ſaline part of Sweat, intercepted in the Pores of the Skin; whereupon he conceives that Ox's Gall diveſted of its oily Parts, and reduced to the Alcaline only, would become a Diſſolvent for the Freckles.

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Upon a Singular VEGETATION.

WE ſhall repeat nothing here of the Fact related by Monſ. *Marchant* in his Diſſertation; but, as he has recourſe, in the Explanation of it, to a particular Suppoſition, which belongs to the general Syſtem of the Multiplication of Plants, we will treat of it with ſome Extent, and endeavour to enlighten it as well as we can.

The Eggs of Animals and the Seeds of Plants are the ſame thing: An Animal and a Plant contained in little, the one in its Egg, and the other in its Seed, come to be unfolded, and then the Animal is ſaid to be Born; hitherto all is equal on the one ſide and on the other; but Plants have ways of being born or produced, which are not in common with Animals: There are ſeveral that come by ſticking in the Ground; a Branch of a Fig-tree for inſtance, ſtuck into the Ground puts forth Roots, and becomes an entire Plant.

One eaſily conceives that a Body, let it be never ſo ſmall, may be organized and grow afterwards, preſerving the Diſpoſition of its Parts; but that a Part ſhould in growing become the Whole, is what cannot be eaſily comprehended; for whence can it fetch the other organical Parts that are different from it? Accordingly, here the Branch of a Fig-tree get Roots that only belong to the entire Tree, and which it could never have contained in little? No body imagines that from the Leg of an Animal,

mal, one could ever form its Heart, it Lungs, or in ſhort, a whole Creature.

Since one cannot conceive that an organized Part is formed anew, and ſince the Naturaliſts are obliged to ſuppoſe the Pre-exiſtence thereof in little, we muſt neceſſarily grant that there are in the Branch of a Fig-tree little Roots that would never have been unfolded, if ſuch a Branch had not been divided from the Tree, and ſtuck into the Ground. This Suppoſition ought to be ſo much the more eaſily admitted, that to make an entire Tree of a Branch there is nothing to be added to all that appeared naturally in it but concealed Roots; and that thoſe Roots which would not have ſhewed themſelves if the Branch had not been ſeparated, or if it had remained wholly in the Air, may have been determined to appear by the Earth's touching that part of it which was put into the Ground. The Roots are infinitely leſs different from the Body of the Tree, than one organical Part of an Animal is from the reſt.

All the Ways by which Plants can be multiplied otherwiſe than by Seeds, are reducible for the Phyſical Syſtem to what we have juſt now explained; and in Monſ. *Marchant*'s Diſſertation you may ſee ſeveral Experiments to prove that the ſmalleſt parts of Plants, and which have been ſeparated from them in different Manners will gow and produce an entire Plant. Thus a Plant contains Seeds in all its Parts, or which is the ſame thing, it is a Heap and a Compoſition of an infinite Number of the like ſmall Plants, which do not appear but as Parts of that Whole, and which do not ſhew what it is that might make them all perfect

Wholes. The odd Principle of the Scholaſtick Philoſophy, how the Soul is in the Body, *viz. That the Whole is in the Whole, and the Whole in every Part*, is therefore exactly true with reſpect to Plants; and it is pretty remarkable, that *we really find that to be verified in Matter, which before was imagined as a particular and incomprehenſible Property of the Mind.*

After this, it is eaſie to underſtand in general, the Cauſe of ſingular Vegetations or of monſtrous Plants. It is evident, that the manner in which monſtrous Animals are formed, as explained in the Hiſtory of 1702, would not produce monſtrous Plants; but if by any Accident a Part of a Plant produces what it ought not to do as a Simple Part, and becomes a kind of a Whole to a Part that is monſtrous: The mechanical Structure of Plants being much more ſimple, and conſequently leſs ſuſceptible of accidental Oddneſſes, Monſters in Botany are likewiſe fewer, and leſs ſurprizing.

Upon the Circulation of the SAPP *in* PLANTS.

IN the Year 1667, at the very Birth of the Academy, the late Monſieur *Perrault*, a Man full of Projects, and moſtly of bold ones, and a Philoſopher of a brave and original Spirit, advanced the following Propoſition, which was then very ſurpriſing; *That the Sapp Circulates in Plants as the Blood does in Animals.* It was not known that a Phyſician of *Hamburg* had publiſhed the ſame two Years before.

A Year and half afterwards Monſieur *Mariotte* having been admitted into the Society aſſerted the ſame Hypotheſis as a new one, but found that Monſieur *Perrault* had prevented him; and tho' he was pleaſed to find that this Conformity of their Sentiments was a ſort of Proof of his Syſtem, he was not perhaps leſs ſorry that another had raviſhed the Honour of it from him. The Illuſtrious Monſ. *Malphigi*, in whom the Genius of Invention has ſhined ſo bright, was likewiſe of the ſame Opinion. Meſſieurs *Perrault* and *Marriotte* have both of 'em publiſhed theirs, with all the Proofs, in their *Eſſays upon Phyſicks*; however, the Academy, which values it ſelf upon a prudent Slowneſs, has never been fully ſatisfied in this Matter, and Meſſieurs *du Clos* and *Dodart* amongſt others, have always enter'd their Proteſtation againſt this Opinion.

Monſieur *Dodart* allowed indeed, that there was a Juice which aſcended from the Roots of Plants quite up to the Extremities of the Branches, and even of the Leaves; and alſo a Juice, which from thoſe Extremities deſcended to the Roots. One of his chief Reaſons was, that if you tranſplant at the ſame time two Trees of the ſame Kind, after having cut their Branches and Roots, if afterwards the two Trees having taken new Root, you cut off from one of them ſome of the new Branches of every Year, you will ſee that it will thrive much leſs by the Trunk and by the Roots than the other; which proves that thoſe Parts receive a Nouriſhment by the Branches. He fancied that that Nouriſhment was more aërial, becauſe it was formed of the Moiſture of the Air, of the Dews, *&c.* whereas that which came by the Roots was more Terreſtrial. But finally he pretended that the Aſcending and Deſcending Juices were not the ſame, or that the Juice that aſcended did not re-deſcend, and reciprocally; and ſo by Conſequence that there was no ſuch thing as the Circulation of the Sapp.

Monſieur *Magnol* has attacked the Syſtem of Circulation yet more directly, by anſwering in Detail all the Arguments and all the Experiments too that are found in Monſieur *Perrault*'s Treatiſe upon this Subject.

His Arguments are drawn for the moſt part from the Analogy of Plants and Animals, which render the Neceſſity of Circulation equal in both. But this Analogy, as ſpecious and entertaining as it is, if one would attend to it a little, does not ſtrictly conclude much, and it is not difficult for Monſieur *Magnol* to anſwer all that it ſuggeſts. We will not ſtop at this Article, becauſe they are ſimple Probabilities, which it is as eaſie to refute as maintain.

Experiments are more deciſive, at leaſt they ought to be ſo; but oftentimes it is not more eaſy to produce one that ſhall be very concluding and unconteſtable, than a Phyſical Demonſtration conſiſting in a ſimple Argument of 25 Experiments, that Monſ. *Perrault* had collected to ſupport his Syſtem. Monſieur *Magnol* denies the greateſt Part, and pretends that the reſt proved nothing. We will ſtop at nothing, but what is of Importance in the whole. Monſieur *Perrault* had advanced, that when young Sprigs were Frozen or *Browzed* by the Cattle, the reſt of the Tree would languiſh or die, becauſe the evil Qualities contracted by thoſe Accidents, did communicate themſelves to the whole

Body of the Plant by the means of Circulation; that for the ſame reaſon *Miſſeltoe*, and *Moſs* kill the Trees; that when one ſtrips them entirely of their Leaves, their Fruit does not thrive ſo well, being deprived of that Juice which was to have been communicated to them by the Leaves; that if one makes a Ligature at the Stalk or Body of a Plant that is accuſtomed to yield a great deal of Juice, ſuch as the great *Tithimale* or *Milk-thiſtle*, the Stalk will ſwell above the Ligature, which proves both that there is a deſcending Juice, and that this Juice is more Coarſe and Thick than the aſcending, ſince the latter cauſed no Swelling; that if you cut the Stalk of a Poppy four Fingers below its Head, one ſees, when it begins to die, a very white Juice come out of it aſcending, and a yellowiſh deſcending. Monſieur *Magnol* peremptorily denies all theſe Facts. It is not to be doubted that Monſieur *Perrault* ſaw them, but probably did not repeat them often enough, nor ſift them every way as narrowly as he ſhould have done: *A Man ſhould ſtand upon his Guard, even againſt himſelf when he ſees things that he is deſirous of ſeeing.*

There are ſeveral other Facts that Monſ. *Magnol* admits, but diſputes the Conſequences which Monſ. *Perrault* draws from them; for inſtance, there are Trees, ſuch as the Elder, the Vine, *&c.* the Branches of which lying along the Ground take Root in it; after which, if they are cut off and ſeparated from the Tree, they become themſelves new Trees, the Poſition of which is contrary to what it would naturally have been. It is true, that then the Sapp which ought to nouriſh the Tree, has a Motion contrary to that it would have had in the ſame Channels; but that only proves that thoſe Channels permit the Sapp to run indifferently the one way or the other, according to the Poſition of thoſe Channels with reſpect to the Earth. That Indifference will be yet more ſenſible if one could make, and that with eaſe too, as ſome Authors have writ, the Roots of a Young Lime-tree become its Branches, and reciprocally its Branches Roots.

To the Experiments whereby Monſieur *Perrault* proves that there are different Juices in Plants, Monſ. *Magnol* anſwers likewiſe, by allowing that there are ſo, and that they ought to be ſuch, ſince there are Parts of a different Nature to be nouriſhed; but he denies that thoſe Juices aſcend, and afterwards deſcend to riſe again.

Monſieur *Perrault* conceived that thoſe Juices which returned from the Extremities of the Branches to the Root, were deſtined for its Nouriſhment, and thoſe that came from the Root, for the Nouriſhment of the reſt of the Tree. Monſ. *Magnol* oppoſes this Opinion by ſeveral Experiments: 1. A Lively Plant cut off even at the Root, will put forth again with Vigour, tho' according to Monſ. *Perrault*'s Hypotheſis, the Root deprived of all Nouriſhment ſhould have died. 2. An Olive-tree likewiſe being cut down to the Ground put forth a great many Sprigs that became Trees. 3. A Bulbe planted in the Ground thruſts out ſeveral Roots before the Leaves. It cannot therefore be the Juice deſcending from the Leaves that ſupplies the Roots with Nouriſhment.

The Circulation by which the Juices are more attenuated, more refined, and in ſome Senſe more tormented than by a ſimple direct Motion, induced Monſ. *Perrault* to affirm that a Juice much prepared is neceſſary to Plants; but Monſieur *Magnol* does not aſſent to the neceſſity of this great Preparation. He put the Stalk of a Tube-roſe, that was blown during a whole Night into the Juice of *Solanum Racemoſum*, mixed with a little Water. This Juice is of the colour of *Lack*, and the Tube-roſe became a fine Roſey colour. It did not appear that the Juices which produced ſuch a change in the Colour of the Flower, and which by Conſequence did very intimately nouriſh the Plant, could be much alter'd or much operated. We likewiſe know that there needs nothing but a little Water to revive a Plant taken out of the Earth even after it has begun to wither, and ſometimes to make it Vegetate likewiſe.

Nevertheleſs it muſt be owned after all, that Monſieur *Perrault* has ſome Proofs which are not eaſily deſtroyed. He had taken out of the Earth ſeveral Plants of the ſame kind, and entire with their Roots, one of which had its Trunk divided into two Branches; he plunged into Water one of thoſe Branches only, and ſo let it remain ſeveral Days; by which means it did not only continue alive, but alſo put out new Leaves on that ſide which had not been in the Water, whilſt the other Plants were entirely wither'd. Other Authors have made a like Experiment. When one can meet by chance with a Tree ſupported by two great Roots, one of which is uncover'd about a Foot and a half, and cuts it off at four Fingers breadth above

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the Earth, ſo that the upper part, which is above a Foot in length, muſt wither if it only attracts its Nouriſhment from the Earth, with which it has no longer any Communication, yet far from withering, the Year following it will put forth Branches and Leaves. Theſe Facts which are not diſputed, prove the motion of the Sapp from the top to the bottom, but can that be called Circulation? Here follows another Fact that does prove it, or at leaſt that there is a Juice aſcending, and another different Juice which deſcends by other Channels.

They took a piece of a ſmall Branch of an Elm without Knots, about the length of three Inches, and at each end they faſten'd a little Tunnel made with Wax; then they cut the Branch in two, and poured Water into thoſe Tunnels. The Water did not paſs, but into that piece of the Wood which had the Tunnel at the end that was neareſt the Branches. After this, inſtead of Water they put Spirit of Wine into the Tunnels, which readily inſinuated it ſelf into that piece where the Water could not paſs, but was a great while a getting thorough that Piece which had admitted the Water; the ſame thing happen'd to other ſorts of Wood. Upon conſidering the Poſition of theſe two pieces of the Branch, when they made part of the Tree, Monſieur *Perrault* concludes, that the Tubes or Channels, which ſuffer'd the Spirit of Wine to paſs, were *Aſcending*, but thoſe which admitted the Water *Deſcending*; and that the Liquor which ran thro' the Aſcending Channels, were more Spirituous and Subtile, but thoſe in the Deſcending more Coarſe and Watry. Hitherto the whole is pretty well proved, at leaſt as to ſome kind of Trees, and afterwards it is a Conjecture, that may paſs for probable, that theſe two different Liquors are but the ſame, which being filled with Spirituous Parts, when they Aſcend from the Root, leave by the way the greateſt quantity for the Nouriſhment of the Trunks and Branches; and after that brings nothing more from the Extremities of the Branches, but its moſt groſs Parts, mixed with the Moiſtures of the Air, or with Rain-Water. Monſieur *Perrault* ſuppoſes moreover, that this returning Sapp is fitteſt for the Nouriſhment of the Branches.

Upon this Matter, as well as upon many other, one muſt wait for farther Light from time. *It is difficult in Phyſicks to get as far as a Syſtem, it is even ſometimes as hard entirely to overturn one.*

Upon the Progreſſive Motion of ſeveral Kinds of SHELL-FISHES.

THO' Animals in general have an indiſpenſable need of Progreſſive Motion, whether it be for procuring their Food, or other Occaſions; there are nevertheleſs a great Number, that by their Figure alone ſeem uncapable thereof; ſuch are ſeveral Sorts of Shell-Fiſhes; and it is for this Reaſon that Monſieur *Reaumur* has obſerved them very carefully, leaſt they ſhould, as one may ſay, rob us of their manner of Walking; for oftentimes ſuch a matter of Fact, tho' altogether External, is as hard to be diſcover'd, as the Internal Structure of the Parts of Bodies.

The late Monſieur *Poupart* has already obſerved that the River-*Muſcles* lying upon the flat Sides of their Shells, did protrude, as often as they had a mind, a part, which from its uſe one may call a Leg or an Arm, that it ſerved to dig the Sand under them, and conſequently to turn them gently on one ſide ; ſo that at laſt they would be upon the Edge of their Shells, after which they put forward this ſame Leg as far as they could, and then leaned upon its Extremity to draw their Shells to them, and ſo ſlide along in a kind of a Track or Channel, which they formed in the Sand, and which ſupported the Shell on both Sides: When one looks upon a Muſcle, one would not think it capable of this Expedient and Reſource of Mechaniſm.

Monſieur *Reaumur* has obſerved in the Sea-Muſcles, what one may alſo call their Leg or Arm, and which, being in its natural State, is but the length of two Lines, and yet can be extended or produced by them as far as two Inches out of their Shell, whereby the Animal having laid hold of ſome fixed place, it contracts its Arm again, and conſequently advances by drawing it ſelf along.

By ſuch a kind of Management, the Detail of which we leave to him that diſcovered it, the *Lavignon*, another Shell-Fiſh, marches upon the Mudd or ſinks it ſelf into it ; But Monſieur *Reaumur* obſerves, that tho' he ſinks himſelf down, it is not deeper than the length of two Horns, or Tubes, that he thruſts out of his Shell, will permit him ; and that it is with thoſe Tubes that he takes in and throws out Water, of which he probably ſtands in need for Reſpiration. Theſe Horns muſt always have Communication with the Water that is above him, from whence it happens, that at ſuch times as he does not uſe them, there is in the Mudd, under which he lies, one or two little Holes of the Diameter of thoſe Horns, by which he is diſcover'd.

The length of their Horns in other Shell-Fiſhes that have 'em, do likewiſe determine how deep they hide themſelves in the Mudd.

The *Goats-Eye*, which is a Shell of one piece only, and is always faſten'd to a Stone, to which the lower Circumference of the Shell can exactly apply it ſelf, does not ſeem to have any other Motion than to be able to raiſe its Shell the heighth of a Line, ſo that its Body has a Circumference of that extent naked and uncover'd, but as ſoon as it is touched, the Shell falls down and covers it again. However Monſ. *Reaumur* has diſcover'd in this Animal a Progreſſive Motion upon the Stone to which it glews it ſelf.

The *Ortie of the Sea*, which has the Figure of a broken or blunted *Cone*, is likewiſe always faſten'd upon a Stone by the largeſt Baſis of its *Cone*. Some Circular Muſcles are the Plane of the two Baſis, and ſome ſtreight Muſcles paſs from one Baſis to the other. The whole Mechaniſm of their Progreſſive Motion conſiſts in general herein; that half the Muſcles, as well circular as ſtreight, which are on the ſide towards which the Animal would go, are ſwelled and extended, and conſequently takes up a ſmall part of a new place, whilſt the other half is either drawn by that which advances or puſhes it ſelf on after the ſame manner. This Motion is neither quicker nor more viſible than that of the Hand of a Clock.

There is another *Sea-Ortie* which faſtens it ſelf to nothing, and is the oddeſt of all Fiſhes by its Figure, and the moſt ſingular by its little Conſiſtence, becauſe it will melt in your Hands. It would hardly deſerve to be ranged under the Claſs of Animals, if one did not diſcover in it the Motion of *Syſtole* and *Diaſtole*, the only Tokens it gives of being alive.

Laſtly, The *Sea-Star*, tho' it has 304 Legs at each of the five Rays of which it is compoſed, and from whence it derives its Name of *Star*, does not go the faſter for all that. His 1520 Legs don't give him any advantage above the *Muſcle* that has but one. *What a prodigious Variety of the Works of Nature! Not only the great Swiftneſs of Motion, but even the extreameſt Slowneſs are performed in different Manners.*

Upon the Muscles *of the Lakes or Ponds.*

WE know well enough, at leaſt to a certain Degree, the Animals that are moſt expoſed to our Eyes, and with which we have, as I may ſay, the chiefeſt Dealings: But there are an infinite Number of others which the little Occaſion we have of 'em, the Difficulty of obſerving them, and a certain Contempt ariſing either from their Smallneſs, or Figure, make us neglect or abſolutely deprive us of the Knowledge of them: Such are chiefly the Inſects and ſmall Fiſhes.

Who would believe that there is an Animal that is nouriſhed and reſpires only by the *Anus*, that has neither Veins nor Arteries, and conſequently no Circulation of Blood? To ſay nothing of its being a Hermaphrodite, which is now ſo common, that it is no longer a Wonder; but this Creature however is different from all the other Hermaphrodites we yet know; for as much as it multiplies it ſelf independently of another Animal of the ſame Kind, and is it ſelf both Father and Mother of that which is produced by it. This is an Idea of an Animal entirely New: It is the *Muſcle* of the *Lake* or *Pond* of which Monſieur *Mery* has diſcover'd the Structure in ſpight of its Figure, ſhapeleſs almoſt, and diſcouraging thro' its exceſſive Singularity.

That which one may call the Head in this Creature, tho' there be neither Eyes, nor Ears, nor Tongue in it, but only a little hole to which he gives the Name of Mouth, is an immoveable Part and faſten'd to one of its Shells, ſo that it cannot go and ſeek for its Food, but the Food muſt come to it, and all the Food it uſes is nothing but Water, which when the Shell opens enters in by the *Anus* of the *Muſcle* that likewiſe opens it ſelf at the ſame time; from thence it paſſes into certain Receptacles contained between the Internal Superficies of the Shell, and the External Superficies of the Animal, and at laſt is diſcharged into the Mouth of this Animal when by a certain Motion he draws it in.

At the bottom of the Mouth two Veſſels preſent themſelves to receive the Water, one of which diſperſes ſeveral Branches into the Body of the *Muſcle*, among which one terminates in the Heart; the other Veſſel is a kind of Inteſtine, which paſſes at firſt by the Brain; then makes ſeveral Circumvolutions in the Liver, and paſſing on croſſes the Heart in a ſtreight Line, and at laſt ends in the *Anus*.

This Brain and this Liver are only ſuppoſed to be ſuch Parts, the Heart is a little more really ſo, having in it a Ventricle and two little Ears, and the Motions of *Syſtole* and *Diaſtole* alternately in the Ventricle, and in the little Ears, but there are neither Veins nor Arteries; the Water that is brought to him by the Channel before-mentioned, paſſes from the Ventricle into the little Ears, and returns from the ſame into the Ventricle, making a ſlight Repreſentation of circulating without any apparent Effect, for when it is once come to the Heart, it has no way of getting out again. What then becomes of the quantity that muſt be there amaſſed? Probably there is no Collection at all of it, becauſe the Animal does not continually derive Water by the Mouth to his Heart; and when he has brought a certain quantity into it, the Contractions of the Heart evaporate it through his Pores, and force it into the neighbouring Parts which are refreſhed and nouriſhed by it.

The Channel which Monſ. *Mery* calls the Inteſtine, and which, as well as the other, immediately receives the Water from the Mouth, does not ſeem proper to convey Nouriſhment to the Parts, becauſe it has no Branches to diſtribute it; nevertheleſs it contains, towards its beginning and towards its end, pretty different Matters, the firſt of which may perhaps be the Water digeſted, that is to ſay, the nutricious Juices extracted from it; and the other may be the Excrements.

The *Muſcle* can't reſpire but when it raiſes it ſelf above the Surface of the Water, and it raiſes it ſelf as other Fiſhes do by the Dilatation it makes of the Air contained in it ſelf, whilſt it dilates the

Cavity in which that Air was ſhut up. Then it is ſtill by its *Anus* that it receives the External Air, and conducts it into its Lungs; but it does not ſeem to be very neceſſary to it, becauſe this Fiſh is almoſt always plunged to the bottom of the Water.

Theſe *Muſcles* have both *Ovaria* and *Seminal Veſſels*. Theſe two Kinds of Organs are equally compoſed of Tubes that lie parallel with each other, all cloſed at one end, and open at the oppoſite. One can't diſtinguiſh theſe Parts by their Structure, which is all alike to the Sight, but by the difference of what they contain, and that the more eaſily, becauſe the *Ovaria* are always full of Eggs in Winter and empty in Summer, and that in the Veſicles there is at all times an equal quantity of their Milk, of which there being but very little, it ſhould ſeem that it is always diſcharged. All the Channels or Tubes are diſcharged in the *Anus*; and Monſ. *Mery* is of opinion, that when the Eggs fall down there, at the Seaſon of their coming out, they cannot fail to meet with Milk or Seed, which may render them fertile. This Animal therefore does not want the Aſſiſtance of another for Generation.

Monſ. *Mery* does not agree with the late Monſieur *Poupart*, about the Progreſſive Motion of theſe Fiſhes. He pretends that their whole Belly, which when they pleaſe, they can protrude the length of two Inches out of their Shells, in the figure of the Keel of a Ship, creeps along the Mudd as the Belly of a Serpent does upon the Land: He deſcribes the Muſcles which by their alternate Contractions perform the whole Work of this Mechaniſm.

He does not believe neither, that the Shell of this Fiſh is formed after the ſame manner as that of a Snail, according to Monſ. *Reaumur*'s Deſcription of it. The firſt turns of the Snail's Shell are not bigger in a larger and older Snail, which proves that the Shell is not a Member of the *Animal*, nor made by a ſucceſſive Addition of foreign Parts, but certain *Faſciæ* or *Bands* which one perceives upon the Shell of a Muſcle, are larger in proportion to the Growth of the Fiſh; beſides, this Animal has eight Muſcles faſten'd to the internal Surface of its Shell; wherefore if the Shell does not grow in the ſame manner as the Fiſh, thoſe Muſcles that were firſt faſten'd to certain parts of the growing Fiſh would continually change their Place, even till the Fiſh had done growing, but how is that poſſible? The Difficulty is conſiderable, but perhaps it may be no more than a Difficulty for all that.

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Upon the TREES *killed by the* FROST *in* 1709.

THE violent Winter of the Year 1709, the Remembrance of which will laſt a long time, kill'd a prodigious number of Trees throughout all *France*; but it has been obſerved that this Mortality did not extend it ſelf indifferently upon all: Thoſe which one would have believed ought to have been moſt exempt by their Strength, ſuffer'd moſt of all. The hardieſt Trees and thoſe which keep their Leaves all the Winter, as the Lawrel, Cypreſs, and Green Oak;

and among others that are more tender, as the Olive, Cheſnut and Walnut, thoſe that were oldeſt and ſtrongeſt of 'em died in the greateſt Quantity.

The Cauſe of this appearing oddneſs, was enquired into at the Academy, Monſ. *Caſſini*, the Son, alledged a very plain one with reſpect to the old Trees. He ſaid, he had obſerved that the great Cold had looſen'd the Bark from the Wood, however it came to paſs, in effect it is very Natural that the Bark ſhould ſtick faſteſt to the Wood in young Trees that are much more full of Juice, and of a Juice that is more oily too. Now as according to the common Opinion of the Naturaliſts, it is chiefly by the Bark that the Trees receive their Nouriſhment, it muſt needs have happen'd that thoſe, in which the Bark does moſt eaſily loſe the Communication it had with the Wood, ſhould die ſooner than others.

Monſ. *Chomel* fancied another Reaſon, and that more General. There came firſt a very ſtrong Froſt, which was ſucceeded by a Thaw; then a ſecond Froſt as ſtrong as the former, and very ſudden. The Moiſture of the Thaw wherewith the Trees were filled, was therefore congealed again, that is to ſay, it did extend and dilate it ſelf with great Violence and Quickneſs, and ſo exerciſed upon the Fibres, and all the organical Parts of the Trees, an Effort which was ſo much the greater as it met with more Reſiſtance. Now it is certain it met with moſt from the ſtrongeſt Trees, in which therefore it tore and deſtroyed their organical Parts, Fibres, Veſſels, *&c.* and ſo render'd them uſeleſs for Vegetation.

If one adds to this, according to Monſieur *de la Hire*'s Syſtem, followed by Monſ. *Chomel*, that Cold conſiſts in certain ſaline Particles very penetrating, the Action would have ſtill been ſtronger, and the Effect greater.

That the hardeſt or oldeſt Trees ſhould make ſuch a Reſiſtance as provoked the Enemy the more, there is no room to doubt. Their Parts are neceſſarily cloſer and more Compact; for which reaſon it is that they put forth their Leaves later than others, all the reſt being equal. The Unfoldings in which all Vegetations conſiſt, muſt be performed more ſlowly in thoſe tough Trees, than in ſuch whoſe Parts are ſofter, more flexible, and more impregnated with Juice.

In relation to old Trees, Monſ. *Homberg* did likewiſe give a particular Reaſon of their greater Reſiſtance. Their Fibres which are at their full Growth, and conſequently are every way extended as much as they can be, are not able to undergo a new Extenſion, but powerfully reſiſt all Rarefaction, whether it be of the watry Juices they naturally contain, or of any foreign Moiſture. On the contrary it is viſible that the Fibres of young Trees are capable of being extended every way.

Several Trees that ſeemed to have eſcaped the Cruelty of this Winter, becauſe they put out new Branches and Leaves at the Return of the Sapp in Spring, could not reap the Benefit of that in Autumn, and ſo periſhed entirely. When they were cut they were found more black and burnt at the Heart than towards the *Aubier*, or ſofter part of the Wood next the inner Bark. The Heart, which is the hardeſt, had been more damaged than the *Aubier*, and it was already Dead, whilſt the *Aubier* ſtill preſerved a ſmall remnant of Life.

Upon the Horned or Crooked CORN *called* ERGOT *or the* SPUR.

THE Academy lately received ſome Accounts of a Gangreen or Mortification that was become pretty common in certain Countries, eſpecially in the *Orleanois* and in the *Bleſois*. Monſieur *Noel*, Surgeon of the Hoſpital at *Orleans*, is he that has given the moſt particular Relations concerning it; he acquainted Monſ. *Mery* there were come to his Hoſpital above 50 Perſons, both Men and Children, that had been afflicted with a Dry, Black and Livid Mortification, which began always at the Toes, continued more or leſs, and ſometimes roſe up to the Thigh; that he had but one Patient that had had the Diſtemper in his Hand. The Mortification left ſome without any Application, others were cured by the help of Scarifications and Topics; Four or Five died after the Mortified Part was cut off, becauſe the Diſtemper continued to riſe up to the Trunk or Body. That which was moſt ſurpriſing is, that the Women were not troubled with it, or at moſt a few little Girls.

The Academy was likewiſe informed, that the ſame Accident had befallen a Peaſant near *Blois*, but after a much ſeverer manner. He loſt at once all the Toes of one Foot by the Mortification, after that, thoſe of the other, after that, the reſt of his two Feet; and finally the Fleſh of both Legs and of his Thighs fell off ſucceſſively, and left nothing but the Bones. At the time when this Account was writ, the Cavities of the Bones of his Hips began to be filled with good and new Fleſh.

It was thought, and with pretty much probability, that this ſtrange Diſtemper, which only attacks Poor People, and in the Times of Dearth and Scarcity proceeds from bad Food, and particularly from a certain Corn, Black and Horned, which they call *Ergot*, becauſe it really reſembles the Figure of a *Cocks Spur*. Monſ. *Fagon*, the King's firſt Phyſician, and Honorary Academiſt explains the matter thus.

There are certain Miſts or Foggs that ſpoil the Wheat, but from which the moſt part of the *Ears* of Rye are ſecured by their Beards. In thoſe which this malignant Moiſture can reach and penetrate, it Rotts the Skin that covers the Grain, Blackening it, and Changes the Subſtance of the Grain it ſelf. The Sapp that aſcends into it, being no longer confined by the Skin within the ordinary Bounds, comes in too great abundance; and by its Irregularity Forms a kind of Monſter, which is moreover Noxious and Unwholſome, becauſe it conſiſts of a Mixture of this Superfluous Sapp with a vicious Moiſture.

It is only in the Rye that the *Ergot* is found, and whether it be that the ſame Cauſes which produce the Barrenneſs of a Year, do likewiſe produce it in greater Quantities; or whether it be that in a bad Year the poor People do not ſeparate it from the good Grain, of which they have but a little; 'tis only in ſuch Seaſons, and among thoſe poor People, that the Gangreens we have mentioned, are to be found. Monſ. *Noel* ſays, that as the Rye of *Sologne* had near a fourth Part of *Ergot* in it in the Year 1709, as ſoon as the Country People did eat of the Bread that was made from it, they found themſelves almoſt intoxicated, after which the Mortification often followed; but that in the Country of *Beauſſe* where there was little *Ergot*, theſe Accidents were not known. It may be worth while to read upon this Occaſion a very Remarkable Letter of the late Monſ. *Dodart*, inſerted in the *Journal de Sçavans* 16 March 1676.

The Academy, zealous of promoting the Publick Good as far as it lay in their Power, writ to the Count de *Ponchartrain* what they had learned of the Evil Effects of this Sort of Corn, to the end that he might be pleaſed to take ſuch order in it as he ſhould think moſt proper. The King approved their Zeal, and ordered that Miniſter to write to the Intendant of *Orleans*, to acquaint the Peaſants of his Diſtrict, with the very great danger of the uſe of *Ergot*, and to oblige them to *cleanſe* their Corn thoroughly before they ſent it to the Mill; and for that purpoſe he communicated to him Monſ. *Fagon*'s Memorial upon that Subject.

About the ſame time, and in order to procure a farther Information of this matter, Monſ. *de la Hire* the Son, writ to one of his Friends, a good Phyſician in the Country, deſiring him to examine the Farmers what they attributed the Production of this Horned Corn to, to perſwade them to give ſome of it their Poultry, and to obſerve what would happen thereupon; and laſtly, to Sow ſome of it, and ſee whether it would Spring up; all which was done ac-

accordingly, and he received the following Account about it.

1. *This bad kind of Grain does moſt abound in cold and moiſt Lands, and in rainy Years: A particular ſort of Rye, that is ſown in March, is more ſubject to it than that which is ſown in Autumn.*

2. *The Poultry would not touch it as ſoon as they diſcover'd it, and whatever Art was uſed by mixing it in their Food, they choſe rather to Faſt two or three Days than to eat of it; and yet it did not appear to hurt them, when they eat of it unawares, nor did they ceaſe to lay their Eggs as uſual.*

3. *It will not ſpring up at all, which is very natural, and at the ſame time very happy.*

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Upon the PLANTS *in the* SEA.

THE Study of Terreſtrial Botany, tho' ſo Painful and Fatiguing as it has been repreſented in the Life of Monſieur *Tournefort*, is not however ſo tedious as that of the Marine Botany. One muſt go to Sea along with the Fiſhermen; for otherwiſe, what they don't look for, tho' it would ſometimes make a Botaniſt overjoyed, they throw away immediately, whatever Order you give 'em to the contrary. And what is yet more irkſome, is, that you muſt expect nothing but from Chance, one ſees none of thoſe Plants, the Net takes 'em where it can, and how it can.

Notwithſtanding theſe Difficulties, Count *Marſigli* has begun a very conſiderable *Marine Botany*, all compoſed of Plants of his own getting. He divides them into three Claſſes; the Soft, thoſe that are almoſt of Wood, and the Stony: This Diviſion is not very different from that which the late Monſieur *Tournefort* communicated to the Academy in the Year 1700, tho' Monſ. *Marſigli* declares, that he don't pretend to follow a rigorous Method of Botany.

The ſoft Plants are the *Algus*, the *Fucus*, the *Sponge*, and the *Sea-Moſs*, &c.

The Plants that is almoſt Wood, is the *Lithophyton*, ſo called by the Ancients, becauſe they took it for a Stone Plant. The whole Compoſition of this Plant conſiſts of two Parts, the Bark and the Subſtance; the Bark when it is juſt taken out of the Sea is ſoft, but as it dryes, becomes hard like Chalk, and will crumble between ones Fingers, which probably deceived the Ancients: Its Subſtance is of more the Nature of Horn than Wood; if one Burns it, it riſes in Bliſters juſt like Horn, and has the ſame ſtinking Smell. The Branches of the *Lithophyton* are as pliable as Whalebone, and reſiſt the Knife in the ſame manner.

The Stone Plants, and which only deſerve the Name of *Lithophyton*, tho' they have it not, are the *Corrals* and *Madrepores*. Monſ. *Marſigli* does not mention ſome other kinds, ſuch as the *Stone-Muſherooms*, becauſe they are not found in the Sea about *Provence*. *Corral* is well enough known by its external Figure; the *Madrepore* differs from it in that it has no Bark, is uſually White, and has pretty viſible Holes in it.

Monſieur *Marſigli* having no Books by him when he made his Obſervations, could not Search any Authors concerning the Deſcriptions of thoſe Plants which he had Fiſhed out of the Sea, nor what Names they had given to them, nor under what Claſſes they had reduced them, tho' theſe things are very important in Botany. He was therefore obliged either to call them as the Fiſhermen did, or to give them Names ſometimes at a venture, or finally to leave them without Names, and refer to the Botaniſts of the Academy the Care of enquiring into their true Names, and of diſcovering their general Characters.

Monſieur *Marchant*, who took this trouble upon him, could not ſucceed in it as he deſired; for beſides the difficulty of reducing to certain Kinds thoſe Plants in which the principal Parts that characterize others are not found, ſuch as the Roots, Flowers and Fruits, he had nothing but Monſieur *Marſigli*'s Diſcription of them, and not the Plants themſelves; and if he had had them, that would ſcarce have been ſufficient, becauſe they often change very much, when they have been a while out of the Sea. However, he did all that was poſſible to be done; he ranged ſeveral of Monſieur *Marſigli*'s Plants, under their proper Kinds, and found out the Names that Authors had already given them. We ſhall not however amuſe ourſelves with theſe Diſcoveries, but only Extract from Monſ. *Marſigli*'s Account that which is moſt Philoſophical therein.

The *Algus's* are only the Sea Plants that have Roots, and they therefore ſpring from Muddy Bottoms, like the Terreſtrial Plants. All the reſt, without Exception, grow upon hard Bodies, as upon

Rocks, Shells, pieces of Iron, Conglutinations of Earth, Wood, and even upon other Plants, *&c.* they are cloſely faſten'd to them by their Stalk or Foot; but neither hath this Foot any Fibres proper to draw Nouriſhment, nor can the moſt part of the Bodies that bear theſe Plants be ſuſpected of being capable to furniſh it.

Monſieur *Marſigli* believes, that all theſe Plants which have no Roots are all Root themſelves; that is to ſay, that they attract their Nouriſhment by an Infinity of Pores that are found in all Parts of them; ſome of 'em being full of very viſible Holes. This manner of Vegetating is very convenient for them, becauſe they are ſurrounded with the Water of the Sea on all Sides, which bring them their Nouriſhment; whereas the Terreſtrial Plants that receive theirs from the Earth, but have but one part that is embraced by it, ſtand in need of a particular Diſpoſition and Organs in that Part: And accordingly all the Marine Plants, as far as Monſ. *Marſigli* could diſcover the Contexture of them, both by his naked Eye, and with the help of the Microſcopes, are only compoſed of a heap of little Glands, or very ſmall Veſſels, that filtrate the Sea Water, and ſeparate the Juices that are proper for their Nouriſhment; which Juices are commonly glutinous and milky.

If one Part of a ſoft Plant, or of a *Lithophyton*, is in the Sea Water, it continues freſh and alive, whilſt the other Part that is out dryes away. The contrary happens to Terreſtrial Plants, all the Parts of which will remain alive, provided that one alone of 'em ſtand in the Water; this proves that the Communication which is between the Parts of the Terreſtrial Plants is not between thoſe of the Marine Plants, and that the Parts of the latter are nouriſhed independantly on each other; and by a certain *Appoſition* of Matter, which derives it ſelf to each of 'em in particular. After this general Idea of the Marine Plants, we will collect ſome of the moſt remarkable Particularities obſerved by Monſieur *Marſigli.*

There is a *Fucus*, the Foot of which is a quarter of an Inch in Diameter whilſt the Plants are freſh, but it becomes as ſlender as a Thread when it has loſt the Water it contained.

There is another that creeps along upon the Rock with much Irregularity, ſo that one cannot diſtinguiſh its real Foot.

The *Sea-Orange*, which is a kind of *Fucus*, bears that Name becauſe of its round Figure. It has neither Body nor Branches, and in ſhort is nothing but an Orange, being about 4 Inches and a half in Diameter, but the Subſtance of it is no more than one Line and a half. All the reſt is only a great Concavity, ſuſtained by a vaſt number of Filaments that croſs it, and filled with the Sea-Water that has been filtrated by the little Glands of its Subſtance.

There is another Plant that is nothing but a Bark, and it commonly grows upon thoſe *Lithophytons* that have loſt all, or moſt part of their own Bark. It never covers any but the naked of 'em, ſometimes it cloaths the Stone. When it is alive it is as thick as the back of a Knife; the Subſtance of it is like that of a Muſheroom, and the Colour a bright Red. Its external Surface is all over cover'd with a great Number of Swellings, full of a glutinous

Juice. About thoſe Swellings one ſees many Buttons or little Tubes of an Aurora Colour, which upon a fine red Ground makes a very agreeable Effect. The Internal Surface is quite ſmooth, and accommodates it ſelf to the Figure of the Body over which it is extended. This Plant is of a much more ſingular Nature than the Terreſtrial Plants, that only live upon others.

Several kinds of Sponges when they come out of the Sea, have, in certain little Holes, a Motion of *Syſtole* and *Diaſtole*, which laſts till the Water incloſed in them be quite ſpent.

Some Plants of the Claſs of ſoft ones, when dry, crumble as eaſily between the Fingers as the Bark of the *Lithophyton.*

There is a *Lithophyton* that has ſuch a great Number of Capillary Branches, that it ſeems to compoſe a kind of Tree with Leaves. However, as all thoſe Branches are perfectly of the ſame Subſtance with the Trunk, it is true without Exception, that none of the *Lithophytons* have Leaves.

There is a kind of *Lithophyton* without Bark; its Superfices is cover'd with a glutinous Matter, like a Varniſh, which moſt abounds at the Foot of it. This Plant is all full of Thorns, which appear beſt at the Top of the Branches, where there is leaſt of the Varniſh. One ſees likewiſe about them, as they come out of the Water, certain little Globules of a Glutinous Matter, which when the Plant is put into a Veſſel full of Sea Water, ſpread themſelves about the Branches, making an agreeable Symmetry.

The *Coral* grows ordinarily in Grotto's, of which the Concave Vault is almoſt parallel with the

the Superfices of the Earth; the Sea is as ſmooth there as a Pond, the Fiſhermen aſſure, and Monſ. *Marſigli* believes till now upon his own Obſervation, that *Coral* does not grow in thoſe Grotto's that are open towards the North, they muſt be turned towards the South, or at leaſt towards the Eaſt or Weſt. It grows beſt and quickeſt where the Sea is ſhalloweſt. It grows quite contrary to Terreſtrial Plants, and even to the ſoft Sea Plants and *Lithophytons*; for its Root or Foot is faſten'd to the Top of the Grotto, and its Head or Branches are turned downwards.

It is equally hard, and red, in and out of the Water; only its Bark, as it dries, aſſumes a Colour a little more Livid, and the Extremities of its Branches are ſofter when they come out of the Sea, than the reſt of the Plant, being full of a Juice that is not yet Conſolidated; theſe Extremities as they dry in the Air become Friable.

The Foot by which the *Coral* is faſten'd to a ſolid Body, aſſumes exactly the Figure of that Body, embracing in it the form of a Plate or Covering to a certain extent, which plainly proves that the Subſtance of *Coral* was fluid in its firſt Formation; and that which proves it yet better is, that this ſame Subſtance, tapiſſes or lines the inſide of a Shell, into which it could not enter but as a Liquid.

The Bark extends it ſelf equally throughout, it is leſs compact and leſs hard than the Internal Subſtance which is Stony, and is eaſily ſeparated from it, when the Plant is new; it is filled and all croſſed with little round Tubes, which have each of 'em at their Top a hole ſo ſmall, that its ſcarce perceptible but with a Microſcope; they are full of a

Glutinous Juice, which while the Plant is freſh and young, is of a milky Colour, but being afterwards condenſed aſſumes the Colour of Saffron bordering upon a Red. The Internal Surface of the Bark is all ſhagreen'd or rugged with an Infinity of little Glands.

The Superfices of the *Coral*, diveſted of its Bark, is all traced with Channels that run from the Plate or Foot, quite to the Extremities of the Branches. There is in the proper Subſtance of the Plant a number of theſe little Cells, full of a Juice exactly like that in the little Tubes of the Bark, but theſe Cells are not viſible, and perhaps do only exiſt in the External Circumference of the proper Subſtance; all the inſide appears perfectly Solid and Stony. The Cells are likewiſe larger and more numerous towards the Extremities of the Branches, than towards the Foot.

All this together ſeems ſufficiently to prove that the whole Organical Structure of *Coral*, with reſpect to Vegetation, conſiſts in its Bark, and in the Superficies of the Coraline Subſtance, that the Bark filters by its Tubes a Juice that ſpreads it ſelf between the ſaid Bark and the Subſtance, filling the little Cells thereof, and running along the Channels, even to the Extremities of the Branches; and that this Juice being petrified as well in the Cells which ſurround the Coraline Subſtance, as in thoſe of the Extremities of the Branches, whoſe Subſtance is not yet formed, makes the Plant grow both in Bigneſs and Tallneſs. We are obliged to content ourſelves with this Explanation, tho' very ſlight and imperfect in compariſon of that into which Count *Marſigli* enter'd with Pleaſure, upon ſo ſingular a Vegetation, whereof he has given the firſt Account.

Coral is eaten by the Worms; Monſ. *Marſigli* has given us the Figure of a Piece ſo eaten, and intends to deſcribe it yet better in his Diſſertation upon Sea-Animals.

The *Madrepores* grow commonly in the ſame places as Coral.

Moſt of them change their Colour out of the Sea.

They are commonly more heavy and eaſie to be crumbled. Some of them are as brittle as Glaſs, and others yet more, ſo that one can hardly touch them.

This is what relates to the moſt curious Particulars of the Marine Plants of the three Claſſes, but we have not yet touched upon their Multiplication, an eſſential part, but very obſcure in this Botany. To ſee the Flowers, or Fruits, or Seeds, of a Marine Plant, one muſt be doubly favour'd by Fortune; one muſt draw it out of the Sea by a Net that diſtinguiſhes nothing, and take it exactly at a time when it is in Bloſſom or Seed. And tho' we have always the Terreſtrial Plants under our Eyes and at our own Command; yet there are ſtill ſome of them, as the Muſhrooms and Troufles, which have concealed from us for a very long time the manner of their Multiplication.

Neverthleſs, as the Diligence of an Obſerver compels Fortune to be favourable at laſt, Count *Marſigli*, in the Year 1707, made a Diſcovery which will be for ever famous in the Marine Botany. It is that of the Flowers of Corral, they are white, having each of 'em a little Foot and eight Leaves, which are altogether of the ſize and figure of a Glove. They are very numerous throughout the whole Plant. They come out of all the little Tubes of the Bark, and return into them again at the very inſtant you take the Plant out of the Water; but put the Plant in again, and the Flowers will appear in leſs than an Hour's Time; and in this manner you may deal with it ſometimes for the ſpace of twelve Days, after which the Flowers aſſume the Shape of a little yellow Globe, and fall off from the Plant to the bottom of the Water, the Deſcription of this Phenomenon has been publiſhed more at large in the Supplement of the *Journal des Sçavans* for the Year 1707. It has been long thought that Coral was nothing but a Stone, and what would People have ſaid to have ſeen ſuch a Stone cover'd all over with Flowers? As for us who know that it is a Plant, we cannot forbear thinking that theſe Flowers are very ſtrange. Coral might have been without 'em much better than a great Number of Terreſtrial Plants.

According to the Analogy of other Plants, it ſhould ſeem as if thoſe little round things that fall off from the Coral in the Sea did contain the Seeds thereof; but Monſ. *Marſigli* open'd them and found neither Seed, nor any thing that came near it in them; but only a glutinous Juice, like that he met with in the Bark. Beſides, ſince Corral is faſten'd to the top of the Grotto, where it grows with its Heels upwards, and that thoſe round things fall by their own weight to the bottom of the Water, it would be difficult for their Seeds to ſpring upwards if there were any ſuch in them, unleſs perhaps their weight ſhould diminiſh, or that they ſhould open and their Seeds being lighter than they, ſhould aſcend. But it is better to wave our Conjectures, and ſtay till time clears up this Myſtery of the Seeds of Coral, which cannot be more ſurprizing than what has been before related concerning their Flowers.

Monſ. *Marſigli* obſerved, that the little Globules of the *Lithophyton*, that has Thorns upon it and no Bark, lengthen'd themſelves, put out two Filaments at their top, and at laſt became kinds of Flowers, whilſt the Plant was kept in the Sea-Water; but reſumed their firſt Figure when it was taken out, and ſo *toties quoties*, in which reſpect the appearance was exactly the ſame with that of the Flowers of Coral, and it would laſt ſo two Days; but theſe Flowers, no more than thoſe of Coral, contained any ſolid Seed in them.

The Claſs of ſoft Plants did a little better ſatisfie the Curioſity of Count *Marſigli*. He found one without any Leaves which had very fine Flowers, in ſix white Diviſions, with ſix white Filaments and pretty large round Fruit, each containing ſix little yellow Seeds, and of a very ſharp taſte. He ſaw another Plant, the Cods or Shells of which were empty, and had probably ſhed their Seeds; On the other hand he met with Fruits fallen off from their Plants, one of which was like a Fig, having Seeds in it: Another was a kind of little Olive, and is ſaid to be the Fruit of the *Algus*, and has a ſolid Nut or Stone in it. There are likewiſe ſome ſoft Plants, and particularly the *Plant-Bark* which diſcloſed no Seed, but in lieu of it there were Flowers which appeared and diſappeared again juſt like thoſe of Coral, and of the thorny *Lithophyton.*

Thus we know the Flowers in each of the three Claſſes, and the Seeds in that of the ſoft Plants; conſiderable Beginnings in the Marine Botany, and wholly owing to Monſ. *Marſigli*, to whom we ſhall probably be ſtill more beholden for a farther Progreſs in theſe unknown Paths of Natural Philoſophy.

Upon the Manner how ſeveral Kinds of SHELL-FISHES *faſten themſelves to certain Bodies.*

WHen we treated of the progreſſive Motion of ſeveral Kinds of Shell-Fiſhes in the Hiſtory of 1710, we took notice of the almoſt perpetual Immobility of ſome of 'em, for one cannot treat of their progreſſive Motion, without ſaying that the moſt part have none, and in that reſpect are more a-kin to Plants than Animals. There are even ſome of them that never once ſtir out of the place, where, as I may ſay, they firſt took Root. It is concerning their Immobility that we are now a going to ſpeak, from Monſ. *Reaumur*, Author of all the following Obſervations.

The *Goats-Eye*, a Shell-Fiſh ſo called, faſtens its ſelf by a very flat Baſis to the ſmootheſt Stones, and faſtens its ſelf to them ſo ſtrongly, that being placed in a Situation in which the ſaid Baſis and the Stone were vertical, they were obliged to make uſe of a Weight of 28 or 30 Pounds to make the Fiſh let go its hold. It is remarkable that the Baſis which is Elliptick is not above an Inch in its largeſt Diameter. From whence then proceeds ſo great a Strength? It is hardly probable, conſidering the ſmoothneſs of both Bodies, that the Baſis of the *Goats-Eye*, let it be never ſo Muſculous, can ſufficiently inſinuate it ſelf into the imperceptible Aſperities or Ruggidneſs of the Stone; and in ſhort, ſuch an Inſinuation would not have any great effect in a vertical Situation. And ſo likewiſe Monſieur *Reaumur* has ſatisfied himſelf by ſeveral deciſive Tryals, that this Shell-Fiſh is ſo ſtrongly faſten'd to the Stone by the means of a Glue that comes from it, and that even the Action of the Muſcles of its Baſis, which we may alſo add, has no ſhare at all therein.

This Glue is yet more remarkable in the *Sea-Orties*, which do likewiſe joyn themſelves no leſs cloſely to Stones. Theſe Creatures are neither cover'd with Scales nor Shells, nor is their Skin a Membrane or Texture of ſolid Fibres, 'tis no more than the Skin or Film of a viſcous Matter, which is immediately diſſolved in Brandy, whilſt the reſt of the Body remains entire, and without alteration.

The 1520 Legs of the *Sea-Star* do not ſeem ſo much to be given to it in order to promote, as to retard its Motion. They are very ſoft, and ſerve to glue this Fiſh to the neighbouring Bodies; inſomuch that you break them off when you attempt to unfaſten them.

The *Sea-Muſcles* have a way of faſtening themſelves, that is the moſt ſingular of all. They throw out from their Bodies, Fibres or Threads as thick as a good big Hair, and at moſt as long as three Inches, and ſometimes about the number of 150 of 'em; with theſe they lay hold on ſuch things as are round 'em, and moſt commonly of the Shells of other Muſcles. They throw them every way, and they hold themſelves by them as by Ropes that have different Directions. Monſieur *Reaumur* did not only obſerve that they ſpun theſe Threads, and that when they were cut off they ſpun more; but he has likewiſe diſcover'd the curious Detail of the Mechaniſm they uſe therein.

The *Marine Pinnes*, another kind of Shell-Fiſh, faſten themſelves likewiſe by Threads much finer than thoſe of Muſcles, but in a much greater Number. People make fine Works with thoſe, whereas the Threads of the Muſcles are good for nothing. The *Marine Pinnes* may be accounted the Silk-worms of the Sea, and the Muſcles the Caterpillars.

Laſtly, the Worms that are called *Tube-Worms*, becauſe being otherwiſe pretty like the Earth-worms, they are incloſed in a round Tube or Pipe of a ſhelly Subſtance, make themſelves a Habitation which they never forſake, by faſtening their Tube either upon a Stone or upon hard Sand, or or ſome other ſorts of Shells. This Tube follows exactly the Compaſs or Windings of the Surface to which it is glued; riſes or ſinks with it, *&c.* It even creeps along without being obliged to it by this Surface, and becauſe it ſeems to have followed the Natural Motions of the Worm. All this is explained of it ſelf, in Mr. *Reaumur*'s Syſtem, who pretends that this Tube, like the Shells of Snails, is formed of the viſcous Matter that perſpires from the Body of this little Animal.

Another Species of Sea-worms, which probably do not perſpire ſo much of the like Matter, make themſelves a Tube or Shell of nothing but the Grains of fine Sand and the little Fragments of other Shells which they glue together, and this little Building of chequer'd or inlaid Pieces, is nevertheleſs very neatly formed.

It is by the means of the like Glue that Oyſters faſten themſelves to Rocks, and even to each other; and in a word, this is the univerſal Cement that Nature makes uſe of whenſoever ſhe has a Mind, as one may ſay, to build in the Sea, or to ſecure any thing againſt the violent and perpetual Motion of the Waters. *The plaineſt and ſimpleſt Methods well applied are always the moſt effectual.*

Upon a New Kind of PURPLE.

WHere are not only more Things found out in theſe latter Ages than were loſt in former, but there can hardly any thing at all be loſt that was worth the keeping: For in ſhort, one need only ſeek for it in the Boſom of Nature where nothing is annihilated; and it is even a great ſtep towards finding it again, to be ſure that it can be found.

The Colour of *Purple*, formerly ſo highly valued, that it was one of the principal Signs of
Dignity

Dignity among the *Romans*, either has not been, as was believed, quite loſt, or at leaſt was found again about thirty Years ago by the *Royal-Society* in *England*. One of the Shells from whence it proceeds, and which is a Kind of *Buccinum*, is common upon the Coaſts of that Country.

Another *Buccinum*, which likewiſe yields the Tincture of Purple, and probably one of thoſe deſcribed by *Pliny*, is found upon the Coaſts of *Poitou*, and Monſ. *Reaumur* enquiring into it more nicely found out another Purple where he did not look for it, and which according to all appearances was unknown to the Ancients, tho' of the ſame Kind with their own.

The *Buccinum* of *Poitou* that yields Purple, is commonly found among certain Stones or Sands, which are cover'd with Oval Grains of the length of three Lines, and of the bigneſs of a little more than one, full of a white Liquor, but enclining a little to yellow, not unlike that which is drawn from the *Buccinum* it ſelf; this Liquor after ſome Changes aſſumes the Colour of Purple. After ſeveral Experiments and Obſervations, Monſ. *Reaumur* is of Opinion theſe Grains are not the Eggs of any of the Shell-Fiſhes called *Buccinum*; neither are they the Seeds of any Marine Plant, they muſt therefore be the Eggs of ſome Fiſh. They don't begin to appear but in Autumn.

If you break theſe Grains upon a white Cloth, they only tinge it at firſt with a yellow Colour, and that ſcarce viſible too, but in three or four Minutes it turns to a fine bright Purple, provided you expoſe it to the open Air: for (which is well worth obſervation, and which ſhews the exceeding niceneſs of the Production of this Colour) the Air of a Chamber, tho' the Windows be open, will not ſuffice. The Tincture of theſe Grains is diminiſhed a little, by frequent waſhing the Cloth.

Monſ. *Reaumur* has diſcover'd by ſome Experiments, that the effect of the Air upon the Liquor of the Grains conſiſts, not in depriving it of any of its Particles, nor in giving it any new ones, but ſimply in agitating and changing the Diſpoſition of the Parts that compoſe it.

Cocheneel is a very fine red Colour, but it is only proper in Woollen, and is good for nothing either in Silk or Linnen.

Carthame yields a fine Poppy-colour and Crimſon, but it is only proper in Silk. If one improves theſe Grains of Monſ. *Reaumur*, one may find out a fine Red that is neceſſary for Dying Linnen, and which will perhaps exceed the Red of the *Indian* Linnens, which is not very fine.

Monſ. *Reaumur* compares his new Purple with that which is drawn from the *Buccinums* of *Poitou.* Thoſe *Buccinums* have at their Collar or Neck (for we may allow them one as well as the Snails) a little Receptacle, or Veſſel improperly termed a Vein by the Ancients, which contains no more than one good drop of a yellowiſh Liquor. The Linnen that is tinged therewith being expoſed to a moderate Heat of the Sun, aſſumes at firſt a greeniſh Colour, then a Lemon Colour, next a brighter Green, afterwards a deeper, then a Violet, and laſt of all a fine Purple. This happens in a few Hours; but if the Heat of the Sun be very ſtrong, the fine Purple appears at once without ſhewing the Preliminary Colours. A great Fire produces the ſame Effect, only a little more ſlowly, nor is the Colour quite ſo perfect. Without doubt the Heat of the Sun, much more ſubtile than that of our common Fires, is more proper to agitate the fineſt Particles of the Liquor. The open Air does likewiſe operate upon the Liquor of the *Buccinums*, eſpecially if infuſed in a good quantity of Water, but not ſo quickly; from whence Monſieur *Reaumur* conjectures with a great deal of probability, that the Liquor of the *Buccinums*, and that of the Grains, is pretty near of the ſame Nature, ſaving that the latter is more watry. They differ likewiſe in the Taſte; that of the Grains is ſalt, that of the *Buccinums* extreamly pepper'd and biting; perhaps becauſe there is leſs Water uſed to it.

If one would make uſe of them in Dying, that of the Grains would be moſt convenient, and coſt leaſt, it being very eaſie to extract the Liquor from a great quantity of Grains, which might be bruiſed all at once; whereas to come at that of the *Buccinums*, you muſt open the Receptacle of each Shell ſingly, which would take up a great deal of Time; otherwiſe, if for Expedition you ſhould bruiſe the ſmalleſt of thoſe Shells together, the Colour would be ſpoiled by the mixture of different Matters that come together from the Animal.

One might perhaps find Chymical Preparations that could make the Purple appear ſooner, or more eaſily than the Fire, the Sun, or the Air; and Monſ. *Reaumur* has already produced ſuch an Effect upon the Liquor of the *Buccinums* with the corroſive Sublimate, *but practice, and eſpecially that which*

which is required in an Art, muſt be eſtabliſhed by many more Obſervations and Trials. There is a vaſt difference between a Naturaliſt that aims at Knowledge, and an Artiſan that ſeeks nothing but Gain.

Upon CORAL.

AS Count *Marſigli*'s Hiſtory of the Sea had awaken'd the Attention of the Chymiſts upon the Analyſis of the Marine Plants, and eſpecially of *Coral*; Monſieur *Lemery* has added an Account of ſome new Operations upon this Plant to thoſe which he had already given in his Treatiſe of Chymiſtry. 'Tis thoſe new Operations, or rather that which is moſt ſingular in them, which we are going to relate here.

After having uſed in the Diſſolution of *Red Coral* either diſtilled Vinegar, or the Spirit of Venus, which is a Vinegar impregnated with ſome Volatile and Sulphurious Particles of Copper, Monſieur *Lemery* tried other Acids that were much ſtronger, ſuch as the Spirits of Vitriol, Alum, Nitre, and Salt. Theſe produce a much greater Efferveſcence and a more ſenſible Heat than the other weaker Diſſolvents; and their Strength is a plain reaſon of ſuch an Effect. Nevertheleſs, when one would make uſe of Coral in Phyſick, it is beſt to diſſolve it only with diſtilled Vinegar, or the Spirit of Venus, which will make a ſofter Impreſſion upon it, without exhauſting its Alcaline quality in which all its Virtue conſiſts. *Coral* diſſolved by the Spirit of Vitriol makes a kind of Vitriol, and accordingly the Colour of that Diſſolution is greeniſh. The reaſon of which is, that the Acid of the Vitriol is incorporated with the Coral, as in a Matrix. When one precipitates diſſolved Coral with Oil of Tartar, it is turned to a very fine white Powder: For as ſoon as it is minutely divided, it loſes its red Colour. This precipitated Coral will ſtill ferment with Acids, for in reality it has received no other Change but to be very much attenuated.

When it is in this Condition, tho' it were ſo only by ſimple pounding, a Knife touched with a Load-ſtone, will diſcover a great many Particles of Iron in it. But there are none to be found in Crabs-Eyes, in Pearls or Mother of Pearls, nor in Harts-horn even after calcining them, tho' all theſe Matters do by Chymical Analyſis pretty much reſemble that of Coral. It is true, they are the Production of living Creatures; whereas Coral is a Vegetable. *But from whence ſhould a Marine Plant, that is only fed by Water wherewith it is ſurrounded, get Iron? or which is moſt ſurprizing, to find Iron in Coral, or in Honey?*

Tho' the true Salt of Coral be either a Volatile Alcaline and Urinous Salt, which is extracted from thence by Diſtillation, or elſe a fixed and Alcali Salt, produced by Calcination and Lixiviation, the Chymiſts do not call any thing Salt of Coral, but ſuch a Coral as is penetrated by Acids, and condenſed afterwards by the Evaporation of the Moiſture. When this Evaporation is almoſt at an end, the Liquor aſſumes a greeniſh Colour, which

Monſieur *Lemery* attributes to the Vitriol, or which is the ſame thing almoſt, to the Iron contained in the Coral. This kind of Chryſtallization of Coral is made in little fine Branches, interlaced with each other in ſuch manner, that they make an agreeable appearance of a little Foreſt. A Chymiſt, inclin'd to the Roſicrucian Temper, would eaſily miſtake this for one of thoſe boaſted *Palingeneſes* or Reſurrections, in which the mixed Bodies uncompounded and reduced to their firſt Principles revive from their Aſhes, and reſume their former Figures; but the Miſchief is, the ſame thing equally happens to all the Salts drawn from Crabs-Eyes, Pearls, Harts-horn, *&c.* they all turn to Foreſts, tho' their Mixtures had not the leaſt Reſemblance thereto.

Hitherto the Queſtion has been only about Red Coral; the White, if it be a Coral, and not a *Madripore*, appears to be pretty much of the ſame Nature, and ſhould be applied to the ſame Uſes in Phyſick: Only it ſeems to be more porous and ſpongy; accordingly it ferments leſs briskly with the ſame Diſſolvents which find it more open. Probably the red Colour proceeds from a Sulphur that ſtops or contracts its Pores.

As for what they call Black Coral, it is none at all, but only a kind of *Lithophyton*.

Upon TRUFFLES.

SInce there are Animals that have hardly any thing of the Nature of Animals in them, we ſhould not think it ſtrange if there be Plants that hardly deſerve to be ranked among the Number of Vegetables: It ſeems as if every Species were to begin by the infinitely Little of the ſame; that is to ſay, by thoſe that have leaſt of the Marks or Characters of them, and from thence to riſe gradually till you come to thoſe that are the moſt Perfect.

Truffles have neither Roots nor Fibres that may ſupply their place; nor Stalks, nor Flowers, nor any appearance of Seeds: Nevertheleſs they certainly are Plants, and the leſs they appear ſo, the more ſhould they excite the Curioſity of Botaniſts; and accordingly, Monſ. *Geoffroy* the younger, has undertaken to examine them with a particular Care. All that he could diſcover in them, that might induce him to believe them organized Bodies, was the Marbling they aſſume, after having been altogether, and very uniformly white throughout their internal Subſtance, which was cover'd by a dark or brown Skin. This Marbling can only be occaſion'd from ſome Parts becoming brown or black, whilſt others preſerve their former whiteneſs; and this ſufficiently proves the difference of thoſe Parts, which is not viſible but at a certain Degree of Maturity. Some of theſe Parts muſt be Veſſels, and perhaps all of 'em may be different ones. If you nicely trace the white Parts, you may ſee them extended from the Centre of the *Truffle* quite to the Circumference, and to the Skin it ſelf; and it is from thence Monſ. *Geoffroy* conjectures that they are rather real Channels; and as the brown Subſtance appears thro' a Microſcope to be all formed of little Veſſels, that may be the Fleſh and Pulp of the Fruit. This Pulp is ſprinkled with an infinite number of little Points, black, round, ſeparate, incloſed in the little Veſſels, and which one might take for Seeds, becauſe in ſhort one finds nothing elſe that has the leaſt appearance thereof.

Truffles which never ſpring out of the Earth may therefore be compared to a Marine Plant, ſince it is encompaſs'd on all Sides with its Food, which it attracts by the Pores of its Skin; and as it is for this reaſon that the Sea-Plants have no Roots, ſo neither have the Truffles any need of them. This Plant appears at firſt juſt like a little round Pea, red without and all white within: It ſtill preſerves its round Figure as it grows, becauſe it draws its Nouriſhment equally on all ſides. If it be true, that a little Piece of Money was found in a Truffle, as *Pliny* relates, one may eaſily conceive that it was no hinderance to its attracting the Juices of the Earth, excepting by thoſe Parts upon which the Money lay, and that the other Parts growing in the mean time, extended themſelves every way over it, and ſo at laſt incloſed it. When the Truffle by being over-ripe rots in the Ground, the little Veſſels that contained the inviſible Seeds ſhed them; and theſe Seeds, the only Remains of all the Subſtance of the Fruit, being gather'd in ſeveral little Heaps give Birth to new Truffles, which did therefore grow a good many of 'em together.

By all the Chymical Experiments Monſ. *Geoffroy* made upon Truffles, they appear to abound with a Volatile Alcali-Salt mixed with Oyl; he could find no Acid in them, from whence it comes probably that there is ſuch a great Evaporation of their Odour; thoſe Principles of this mixed Body, which are the lighteſt and moſt ſubtile in their Nature, having nothing to bind and unite them to each other. But we will enter no farther into this Matter, nor into all other Enquiries or Reflections of Monſieur *Geoffroy*; our only Deſign was to ſhew how a Truffle might be eſteemed a Plant. *The moſt ſurpriſing Varieties, as ſoon as they are fathomed, are found conſiſtent with the Uniformity of the general Syſtem of Nature.*

* * *

Upon the Nouriſhment of PLANTS.

THE Vegetation of Plants is more obſcure than that of Animals; there is not indeed much Skill required to find out that they draw their Food from the Earth by their Roots, but when that is done, all the reſt is ſufficiently hidden. We know not the way of the Juices, that nouriſh and circulate in the Plants, as we do that of the Blood; and the Tubes and Channels thro' which they paſs, are neither ſo obvious or viſibly diſtributed, as are the Blood-Veſſels. In a word, the Uncertainty is ſo great, that it is ſtill doubted whether it be chiefly by the Bark or by the Pith, or in thoſe that have no Pith by the woody Parts that Plants are nouriſhed.

The Common Opinion has hitherto been for the Bark, but Monſ. *Parent* has already oppoſed it, by the Example of an Elm in the Gardens of the *Tuilleries*, which lived and produced Leaves, tho' it was entirely ſtript of its Bark from Top to Bottom; he has now added other Experiments and new Reflections.

He ſaw in the Garden of *Luxenburg* four Elms, which, with a deſign of killing them, had been ſtript of their Bark to the Quick, beginning at a little Heighth from the Ground, without leaving but a very little towards the top of the Trunk, and in one of the Four none at all: They lived notwithſtanding four or five Years, and put out both Leaves and Flowers.

The Plantane and the Cork-trees ſhed their Bark and get a new one, juſt as the Serpents do; in the Interval, between the old and the new Bark, it is plain they can have no nouriſhment from thence, and conſequently that they never have. It is true, there is a new one formed under the old, as the latter is looſening in order to fall, but this young and weak Bark does not ſeem proper to nouriſh the whole Tree.

There are Trees, as the *Elder*, the *Vine*, *&c.* which have a great deal of Pith and little Bark, and this ſeems to prove already that they receive their Nouriſhment from the former and not from the latter; but beſides, as they grow old, they are full within of Wooden Fibres, which appear in the place of the Pith, from whence one may ſuppoſe both that the Pith is properly by its Nature to form Woody Fibres, and alſo conſequently to ſupply the Wood with its nutritious Juice, and that it is the Pith effectively that does it, ſince the Tree ceaſes to grow, and to be plentifully nouriſhed, and in a word, becomes old at the ſame time that the Pith diminiſhes.

The Grafts cannot take hold without being joyned to the Woody Parts of the Tree; 'tis then from thoſe Parts that they receive their Nouriſhment.

If it were the Bark that fed the Tree, then the new Woody Subſtance which is formed would come out of it; and if on the contrary, it be the Trunk, the new Bark would proceed from it. Now we find under the Bark of old Elms, *Strata*, or Beds that have been lately formed; the only queſtion then is, to know whether theſe belong to the Bark or to the Trunk; in the firſt Caſe the Trunk muſt have given them, as I may ſay, to the Bark; in the Second, the Bark muſt have given them to the Trunk. Monſ. *Parent* pretends that they belong to the Bark, both becauſe they are ſometimes wholly looſened from the Trunk, tho' ſtrongly glued to each other, and alſo becauſe they are perfectly of the Nature of that fine Bark or Vellum which is under the coarſe one. We ſee ſtill more plainly in the *Chineſe Palm-Tree*, that this thin Vellum is deſtined to form the Bark, which is nothing but a Reticulary Texture, which being drawn out and extended in its Breadth, reſembles a very clear and thin Cloth; but if it be drawn out Lengthways, it makes a kind of Cottony Ribband, very cloſe and very ſtrong, which is uſed by the *Chineſe* for Ropes. This kind of Texture, is not conſiſtent with a Ligneous Body, which does not appear to be any thing elſe but a heap of Longitudinal Fibres, diſpoſed Cylinder-ways, one againſt the other.

The moſt part of the Knots which we ſee come out of the Pith of Trees, and which are often cover'd over with Woody Fibres, ſhew that the Branches derive their Origin and Nouriſhment from the Pith.

Notwithſtanding all this, Monſ. *Renaume* perſiſts in his Opinion, that the Bark is more neceſſary for the Nouriſhment of the Tree, than the Pith or Woody part, which, however, he does not exclude from that Office. For a Proof of which, he gives an Inſtance of ſome hollow or rotten Trees, which had no more Wood remaining in their Trunk than was juſt ſufficient to ſupport the Bark, and yet were alive and fertile too. He now returns his Anſwer to the Principal Facts alledged againſt his Opinion.

Parts of a Tree ſeparated from their main Body, may carry away along with them ſuch a Proviſion of Nutritious Juice as will cauſe them to Vegetate alone, in which caſe they are very different from the Parts of Animals, that cannot ſubſiſt without being united to their Whole. Thus Branches of the *Elder*, of the *Willow*, *&c.* tho' cut off, will put out Leaves, and little Branches, without being planted again in the Earth. Sometimes pieces of Wood, that appear dry, will do the ſame; the Cauſe whereof muſt be, that the Air being heated to a certain convenient Degree, Subtilizes and Agitates the Juices that were depoſited in thoſe Parts, ſeemingly Dead. This Action of the Air is very ſenſible in certain *Bulbous Plants*, which cannot ſpring from Seeds but very difficultly; for if you would get Seeds from them that ſhould not be abortive, but come to good, you muſt cut off the Stalks and hang them up in the Air a certain time, after which, the Seeds that come from thence will be fruitful; the reaſon of which is, the Juices of theſe Plants are too Oily and Glutinous, and ſo cannot inſinuate themſelves eaſily into the fine Veſſels of the Seeds which they are to unfold and open; and therefore it is neceſſary that they ſhould be firſt attenuated and render'd more Fluid by the Air. If Branches that are cut off will vegetate, much more will thoſe that remain upon the Tree, and which can never be entirely deprived of new Juices; for tho' there ſhould no more ariſe by the Bark when taken off, and which is ſuppoſed to furniſh them therewith in a larger quantity, they will ſtill receive ſome by the Woody Parts, and eſpecially by the *Aubier*, which is the moſt tender of thoſe Parts, and the moſt like to the Bark.

So Monſ. *Renaume* reſolves the Example of the Elm in the *Tuilleries*; it vegetated without Bark during one whole Summer, by the help of that Proviſion of Juice which it had kept; and as Monſ. *Parent* agrees that it had leſs ſtrength than the reſt, Monſ. *Renaume* thinks that he has a right to conclude from thence, that its Proviſion being ſpent, it was about to die, and therefore the Gardener did well in cutting it down.

The ſame Principle furniſhes Monſ. *Renaume* with an Anſwer to what had been related from

Monſ. *Magnol*, in the Hiſtory of 1709. A Graft of an *Olive-Tree*, from which they had taken about 3 or 4 Fingers breadth of the Bark quite round, bore that Year, above the place that was ſtript, a double quantity of Flowers and Fruits to what it was uſed to do. It is eaſie to ſee why that Tree vegetated in ſpight of the ſtripping off the Bark, and it is ſo much the more eaſie to be conceived, as that Plant is very Oily, even in the Subſtance of its Wood; and that Juices of this kind are more eaſily kept in reſerve. The whole Difficulty is to know, why the Vegetation was more copious; ſince, on the contrary, the Reaſons are plain why it ſhould be much leſs.

Monſ. *Renaume* pretends that the Seeds from whence the Flowers and Fruits are to ſpring, are formed at the ſame time with the young Branches that bear 'em, for the old Wood has never any; that the Buds in which theſe Seeds are incloſed, are eaſily diſtinguiſhed from thoſe that are to bear nothing but Twigs; and that the Gardeners cannot be miſtaken therein, that theſe Fruit-Buds do therefore only want to be unfolded, which ſometimes never comes to paſs perfectly, but in the Second Year; that it is poſſible, that when, beſides the Juices they have in reſerve, new ones aſcend by the Bark, they open in a leſſer Quantity, becauſe there is too much Juice; and that on the contrary, when there is leſs by the ſtripping the Bark, and conſequently when it is more attenuated by the Air, the Juice does the more eaſily inſinuate it ſelf into the little Veſſels, and gives Birth to a greater number of Flowers.

This Anſwer of Monſ. *Renaume* does likewiſe ſolve what Monſ. *Bernard* had propoſed againſt his Opinion in his *Nouvelles de la Republique des Lettres*, for the Month of *Nov.* 1708. 'Twas a Fact almoſt exactly like that of Monſ. *Magnol*'s.

Monſ. *Renaume* relates another, and a very ſingular one, which he had from a Man that was skilful at Cultivating of Trees. About the Cities of *Aix* and *Marſeilles*, when an Olive-tree is worn out, and that they intend to cut it down in ſome Years, they have a way of forcing from it before hand, all the Fruit that it might have contained within, and which it would not have otherwiſe put forth of it ſelf; they take off from one of its young Branches a good Inch of Bark all round, and in the place of it they put another piece of Bark, ſtripped from a Branch of a young freſh *Olive-Tree*, of the ſame ſize exactly with that which is taken off from the other. They take care likewiſe, as you may eaſily imagine, that that which was the upper or lower Parts of the Bark belonging to the young Olive-Tree be exactly applied in the ſame Situation upon the old one; this being done, they dreſs the Tree after the ſame manner as in Grafting, to the end that the Wound may heal, and the ſtrange part become Natural. In order to cut the two Barks more equally, they have a crooked Knife, compoſed of two Blades exactly parallel, and diſtant an Inch from each other, and joyned in the ſame Handle. The Branches of the old Olive-Tree thus grafted, bear Fruit moſt abundantly the following Years; and thoſe of the young one, that had been ſtripp'd of part of their Bark, wither unleſs you cut 'em.

This laſt Fact is entirely conformable to the Opinion of Monſ. *Renaume*; and it is likewiſe a Conſequence of it, that the Bark of a youug Olive-Tree, grafted upon the Branch of the old, produces more than even the Bark of the old would have done, becauſe, according to him, it is the Bark that contains the Buds; and it is very natural that the Bark of a young Tree ſhould contain more and more vigorous ones than that of on old Tree, tho' it belongs to a young Branch. But this Branch of the old Olive-Tree, which produces more Fruit, does not only produce more upon its new Bark, but likewiſe above it, and for that it is neceſſary that the Juices in paſſing by the new Bark, ſhould have acquired a Diſpoſition, and ſome Virtue which they would not have contracted in the proper and natural Bark of the Branch. This is not hard to be conceived; the Young Channels are more free and open than the old ones; and the young Filters or Sieves do beſt perform their Office of Filtration; both one and the other are ſtopp'd in time, becauſe ſome Particles of the Liquors that paſs thro' 'em always ſtay behind, and it is very likely, that from thence proceeds both the old Age and Death, as well of Plants as Animals.

As all theſe Arguments ſuppoſe a Certainty of Obſervations, Monſ. *Renaume* declares, that he would not be ſatisfied till they were all fully and abſolutely verified, and that he ſtill labour'd to procure Confirmations and neceſſary Lights therein. He himſelf has examined the Elms of *Luxemburg* mention'd by Monſ. *Parent*: He found that in that which appeared to have no Bark towards the upper part of the Trunk, there did remain ſome Fibres of the Internal Bark, or Vellum, or *Liber*, call it which you will, and that they had a Communication with the Bark of the Branches. Thoſe Fibres, thro' which had paſſed all the Juice deſtined to the Bark that ſubſiſted no longer, did probably nouriſh the Branches of the Tree, and make them vegetate; and beſides, by the abundance of their Nouriſhment, which they thus received, they were ſtrengthen'd to ſuch a Degree, that they began to make a new Woody Subſtance. Other Fibres of the ſame *Liber* that were younger, and perhaps not formed till after the ſtripping of the Bark, made a new *Aubier* entirely ſeparate both from the firſt Fibres, and from the Woody Body of the Tree. This *Aubier* began already to be cloathed with a new and a thin Bark. The Gardener, who ſaw that his Tree made new Efforts to live in ſpight of him, cut off ſome of theſe new Productions, of which Monſ. *Renaume* ſhewed a Part to the Academy. There remained, others which ſtill cauſed the Tree to grow. Monſ. *Renaume* proved by ſeveral Inſtances, that a very little of the Bark or Liber was ſufficient for the ſame purpoſe. Monſ. *Maraldi* related that a Graft of a Plumb-tree having been broken in ſuch manner, that it only held by a part of the Bark, and being afterwards raiſed and ſupported, produced both Wood, Flowers and Fruit, by the Juices it received from the ſmall Remnant of the Bark, notwithſtanding that the Woody Part, which had been broken, was become rotten.

From this ſame Obſervation of the Elm of *Luxemburg*, Monſ. *Renaume* concludes, that it is the Bark or the Liber that forms the *Aubier*; and as the *Aubier* is the laſt Wood formed, he infers, that all the Wood is formed of the Liber or of the Bark.

We

We muſt conceive the Liber as compoſed of ſeveral Surfaces or Beds, Cylindrical and Concentrical, the Texture of which is Reticular, and in ſome Trees can be really extended or drawn out like a Net, becauſe the Fibres that form it are ſoft and ſupple. Whilſt they are in this Condition, either they are hollow, and ſo are true Channels; or if they are ſolid, their Inteſtines perform that Office. The Nutritious Juice which they continually receive, and part of which they intercept and keep, makes them grow in Length and Bigneſs, ſtrengthens them, and brings them nearer to each other. One may ſuppoſe that the Longitudinal Fibres are thoſe which grow the faſteſt; ſo then that Contexture, which was at firſt Reticular, becomes a Collection of ſtreight Fibres, whoſe Poſition is vertrical and parallel with one another; and in ſhort this is the Woody Subſtance. This Change is greater in the Beds of the Liber that are neareſt to the laſt Pith, and conſequently 'tis the moſt internal Bed, which is the firſt that is glew'd or faſtened thereto, and that becomes a new *Aubier*.

It may be objected againſt this Motion, that the moſt internal Bed is the thinneſt, and for that reaſon does not appear the moſt forward, the moſt unfolded, and the moſt diſpoſed to be converted into Wood. But Monſ. *Renaume* anſwers, that the others are not thicker, but becauſe they are leſs unfolded, and remain ſtill compoſed of ſeveral Beds which have not had the time to ſeparate themſelves by growth from each other.

About the End of Autumn, the Liber is already adhering to the *Aubier*, and in Winter you can ſcarce be able to ſeparate it; the Juices that are both thick of themſelves, and more by the Diſſipation of the Watry Parts they contained, are that Glew which Nature makes uſe of for this purpoſe. Whilſt the *Aubier* preſerves any Softneſs or Suppleneſs, and has ſtill a little of the Nature of the Bark, it may ſupport the Vegetation for a while; but when it is abſolutely turn'd to Wood, it can be no longer of that uſe. The Vegetation of the young Branches is the moſt lively, and that which alone extends it ſelf even to the Flowers and Fruits, becauſe thoſe Branches are as yet hardly any thing but Bark.

In proportion as the Woody Subſtance of the Trunk becomes more Woody, the Pith is compreſſed and reſtricted to ſuch a degree, that in ſome Trees it is quite annihilated. From hence alſo Monſ. *Renaume* concludes, that it cannot be very neceſſary for Vegetation, ſince its uſe is not perpetual. As the Pith is ſpongey, he ſuppoſes it may ſerve to receive the ſuperfluous Moiſtures that tranſpire by the Pores of the Woody Fibres; and if thro' the Exceſs of thoſe Moiſtures, or from ſome other Cauſe it ſhould rott or be corrupted, as it often happens to Elms, the Trees would nevertheleſs grow and vegetate, which is a pretty ſtrong Proof of the little occaſion there is for the Pith.

This is in general the Mechaniſm of the Vegetation of Plants, according to the Syſtem of Monſ. *Renaume*: If we ſhould enter into a greater Detail, we could likewiſe add more Conjectures and more Uncertainties. One might go even to the *Ventricules*, *Inſertions* and *Trachea's*, Parts of Plants which Authors of great Name indeed have endeavour'd to eſtabliſh, and which, perhaps, may exiſt, but which we cannot ſee with the beſt Microſcope any otherwiſe than as we are inclined to ſee them.

Upon Bees.

As Ancient and Eſtabliſhed as is the Reputation of the Bees, *they were not yet eſteemed ſuch wonderful Creatures as they now appear; and we may ſay of them what has been ſometimes ſaid of Deſerving Men; that they get by being known.* Monſieur *Maraldi*, who has obſerv'd them with great Application and Aſſiduity for many Years, has given a very advantageous and very circumſtantiated Account of them, which we ſhall reduce to the moſt important Points, and moſt eaſily underſtood.

The Bee does equally extract its Honey and Wax from Flowers, but not with the ſame Organs. As Honey is a kind of Liquid Matter, which comes out of the Flowers by Tranſpiration, the Bee ſucks it with a Trunk or Snout from the bottom of the Cups of the Flowers; but ſhe meddles with none whoſe Cups are deeper than her Trunk is long, which ſhe doubles and folds up at ſuch times as ſhe makes no uſe of it in gathering Honey. The Liquor thus extracted, is conveyed into a Bladder tranſparent enough to ſhew the colour of it on the outſide. Some part of it ſerves for the nouriſhment of this little Creature, and is diſtributed in the Veſſels of its Body. We ſhall ſhow what becomes of the reſt in its proper place. As for the Wax which is made of the Duſt of the *Stamina* in the Flowers, the Bees takes it up in the foremoſt of their Six Paws, and convey it into a little Concavity which they have in the two hindmoſt, and ſo they carry it away. They often compreſs and thread it with their Paws both for the Convenience of carrying more, and likewiſe to give it a Figure proper for Tranſportation. Sometimes they roll themſelves in the Flowers when they are wet, by which means the little Particles of Wax ſtick to the Hairs of their Body, and ſo they are loaded all round. When the Bee returns to the Hive with its Harveſt, ſhe either diſcharges her ſelf immediately of her Burden, if ſhe can, or elſe does not fail to be aſſiſted by her Companions.

Their Deſign in gathering Wax is to make a wonderful Structure of it, which is called a Comb; it is from thence that the Bees have been always admired, and they are more wonderful upon that account than has been yet believed. The choice Hexagon Figure which they give to the little Cells in their Comb, would be worthy of the beſt Geometricians, who know, both that ſuch a number as they pleaſe of thoſe Figures fills a ſpace without leaving any void, and that this ſame Figure, which has that in common with a Square and an Equilateral Triangle, has ſtill the advantage beyond it of encloſing a greater Space within the ſame Bounds: But this choice of the Hexagon Figure is nothing in compariſon of what follows, amongſt all the Geometrical Methods that could be put in Execution, they do at the ſame time make uſe of that which is both the moſt Simple and the moſt Convenient for themſelves, and ſurely ſuch a Choice as is the moſt Ingenious. What could the moſt able Geometricians do more? The Detail of the Conſtruction of theſe Hexagon Cells, which Monſieur *Maraldi* has moſt nicely obſerved, was not yet known; nevertheleſs, that which does not exceed the reach, and, as I may ſay, the Genius of theſe little Inſects is too Geometrical and too Complicate to find a place inthis general Account thereof.

Tho' there only appears in the Hive a continual and irregular Motion of Bees, skipping about without anyDeſign, yet at the Bottom it is all in great Method and Order, but it muſt be carefully ſtudied. Their Tasks are divided among them as with the *Beavers*. Some Bees bring Honey between two Fangs or Jaws which they have in their Head, from whence perhaps they derive a Liquor which moiſtens and ſoftens it; ſometimes they are the ſame Bees, who of the Wax, which they have thus prepared, raiſe the little Walls of the Hexagon Cells; ſometimes that Office is performed by others; but in ſhort, thoſe that make the Walls are diſtinct from thoſe that poliſh the Work, and it is another ſet of Labourers who execute that Commiſſion, by making the Angles more exact, ſmoothing and plaining the Superficies, and putting the laſt Hand to it: Now as this is not done but by cutting of ſome Particles of the Wax; and as the Bees are mighty good Husbands, there are others who take care to carry off thoſe Particles, which you may be ſure will be none of 'em loſt. Monſieur *Maraldi* has obſerved, that thoſe Bees which build the Walls don't Work ſo long a time as thoſe that poliſh 'em, as if the Labour of Poliſhing was the leaſt fatiguing.

Their Dilligence is extream; a Comb of a Foot in length, and of Six Inches in breadth, and which contains near 400 Cells, is diſpatched in a Day; it is true, that inſuch a Caſe all the favourable Circumſtances muſt be concurring.

They faſten a Comb to the Top of the Hive, from whence it hangs down, but this is only in caſe that the Top or Cover of the Hive is not ſeparable from the other part; for if it be, they will find out and faſten their Comb elſewhere. It is not properly Wax that they make uſe of in faſtening their Combs. They are not ſo Prodigal, it is a very Courſe Glew that does it.

As the Combs are Planes perpendicular to the Baſis of the Hive, which I ſuppoſe to be circular; if there ſhould be one, the Bottom of which were a Diameter, or an entire *String* of that Baſis, it would divide the Hive in two Parts, which could have no Communication with each other. The Bees prevent this Inconvenience, by not making their Combs of ſo large an Extent, and by leaving between two neighbouring Combs, which are pretty near upon the ſame Plane, a ſpace by which two Bees can paſs together on a Breaſt. Beſides, they leave ſome Openings in the ſame Comb, that they may not be forced to go too far about.

The Cells of the Combs are deſtined to two Uſes; the firſt is for their Magazines: They keep in them the Overplus of Honey, which is to ſerve for their Food in Winter: For of that which they ſuck from the Flowers, and which paſſes into the little Bladder abovemention'd, there is but a ſmall Share that is applied to their actual Nouriſhment; they diſcharge the reſt when they return to the Hive and make their Proviſions of it. Moreover, they keep in the Cells already made, the Wax that is to be employ'd in the Structure of others, or to ſerve for other Uſes.

Secondly, theſe Cells are the Cradles of their little ones. But whence come thoſe little ones? it is one of the greateſt Difficulties in this whole Matter to find that out.

The fabulous Traveller, who ſpeaks of a Nation where there is no diſtinction of Sexes, and where he could not diſcover the Propagation of their Species, did perhaps borrow that Notion of the Bees; and *Virgil* was not to blame for praiſing their Chaſtity, and even believing the Story of the *Bull* for want of a better. In a whole Hive compoſed of 9 or 10,000 Bees, there is but one perhaps that brings forth Young. She is longer, and of a brighter Colour than the reſt; ſhe has a grave and majeſtick Gate, and this is the Bee they call their King: There are ſometimes found two of 'em in one Hive, and at moſt but three of this ſame Kind, which makes it doubtful, whether there is more than one of 'em to whom the Privilege of Generation belongs; for by Monſ. *Maraldi*'s Obſervations, it is certain that it only belongs to the Royal Family. All the Subjects are condemned to Barenneſs.

This King commonly produces her young ones in the moſt ſecret Places of the Hive; but when by good Luck ſhe makes choice of ſome that are more viſible, it is even then very hard to ſee her; becauſe the Bees, her Subjects, draw a Curtain before her. This Curtain are they themſelves ſuſpended from the top to the bottom, and faſten'd to each other by certain little Hooks which they have upon their Feet: By theſe means they make in the Air what Figures they pleaſe. The King does thus hide himſelf, either thro' Care for his little ones, or elſe perhaps out of Modeſty; for there is no good thing, but one may think it of theſe Bees. However he could not always hide himſelf from Monſ. *Maraldi*'s Eyes. He obſerved him follow'd by his Courtiers, always in a grave Poſture, and ſaw him lay in 8 or 10 Cells one after another as many little white Worms, which were to become Bees. Whilſt he was hatching, it appeared by certain particular Motions of thoſe that attended him, that they careſſed, applauded, or encouraged him. After that he retires into the hindmoſt part of the Hive, from whence he ſcarce goes out.

By theſe 8 or 10 Worms which he lays at once, and in ſo ſhort a time, and by the other Circumſtances that Monſ. *Maraldi* obſerved, one may judge of his Fruitfulneſs, during the whole time that he is not ſeen, that is to ſay, almoſt all the Year. It muſt be prodigious, when he is alone in a Hive, which is moſt common, 'tis he alone that produces; there comes out of this Hive one Swarm at leaſt every Year, which may conſiſt of about 14 or 15,000 Bees; Sometimes there comes two and even three in a Year, and yet the Hive is as full at the end of Summer as it was in the beginning of the Spring. A new Swarm therefore, if it be the only one of the Year, muſt be all young Princes, ſuppoſing that there come in none but young Bees, and in caſe there ſhould come in old ones, there remains in the Hive a Number pretty near equal to thoſe produced by the King, which is the ſame thing. It is not probable that the King, which goes out of the Hive with the new Swarm, has produced any part of the Bees that accompanied him: And if there goes out of the Hive more than one Swarm in a Year, theſe new Productions muſt ſtill be placed to the account of the old King; unleſs to ſave the Extravagancy of his Fruitfulneſs, one may ſuſpect that he has produced more than one King; that but one of 'em goes out with the firſt Swarm; and that the other, or the two others, remain in the Hive, and there produce their Worms. If this be ſo, a King may go out with a whole Swarm of his own Production, and may be litterally ſtiled the Father of his People; whereas the other King's are only the Brothers, ſince they proceed from the ſame Bee. But let it be underſtood in what ſenſe one will, theſe little Animals have the peculiar Privilege, that Nature it ſelf beſtows a King upon them.

What now remains to be known, is how this Fertility of the King is brought about, and whether it be by Coition. There are hardly any Hives in which we do not find Drones, and in ſome there are even Hundreds of 'em. They are of the ſame form with the Bees, only about one Third longer and bigger, and have no Sting; they have nothing of the laborious Nature of the Bees, but live entirely Idle; neither do they go out of the Hive but very ſeldom and in fine Weather, they return ſoon Home, and bring nothing with them; not but that they are found full of Honey ſometimes, but then they are ſuſpected to have robbedthe Hive of it, for the y are never ſeen to ſettle upon Flowers; and if they ſhould at any time gather ſome Honey, it is only for their own Uſe, and not for the Publick Good; for Monſ. *Maraldi*

raldi having ſqueez'd them, obſerved that Honey would not come out as it does from thoſe of the Bees, and conſequently the Drones can't diſcharge it. It might be thought that theſe Animals were the Males of the great Bee, or King, and that they would not be endured in the Hive, but only becauſe their Lazineſs is abundantly balanced by this important Function. And that which might ſupport ſuch a Notion is, that at the end of the Summer the Bees make War againſt the Drones with great Violence, kill them, or drive them out of the Hive without giving Quarter, ſo that it is not known what becomes of them: It ſhould ſeem therefore that the reaſon of this Cataſtrophe among them is, becauſe they are become entirely uſeleſs, ſince there is no engendring in Winter: But that which makes the Difficulty is, that Monſieur *Maraldi* has obſerved ſome Hives without any of theſe Drones in Summer, and at a Time when the Cells abounded with the little Worms.

The Myſtery therefore of the Generation of Bees do ſtill remain, but the care which they all take in common of the little ones that are none of their own, and which belong only to their King, is very viſible and very remarkable; it may be ſaid that they conſider them as the Children of the State. In every little Cell in which there is a Worm, they put ſome Drops of a Liquor for its Nouriſhment, then they make a Cover of Wax for the Cell; theſe different Operations have their ſtated Times, and are without doubt adapted to the Occaſions of the Embrio. We ſhall leave the Detail of them to Monſ. *Maraldi*, as alſo the Account of the ſucceſſive Growths of the Worm, which at laſt becomes a Fly, breaks thro' the Cover of its Cell, and after a little time of Languiſhing flies away with the reſt. You muſt obſerve that the Bees have ſuch a Spirit of Œconomy, that they will not even ſuffer the broken Covering of the Cell to be loſt, they therefore carry it away into their Common Magazine, to be uſed upon a freſh Occaſion: At the ſame time they reduce the little Cell to its regular Figure, if it has been any way impaired, and put it in a Condition to be uſed for the ſame Purpoſes again: In three Months time there have been five ſucceſſive Litters of Worms in the ſame Cell.

The Drones proceed from the King as well as the Bees. There are in the Combs ſome Cells bigger than others, made for thoſe Worms that are to be turned into Drones, and which conſequently take up more room. Theſe Worms are laid by the King with the ſame Ceremony, and afterwards treated by the Publick with the ſame care as thoſe that are to become Bees. There is no difference till the end of Summer, but when that Time comes, the Bees declare War againſt the Drones, their Rage extends even to thoſe that are yet but Worms, they break the Covers, which they themſelves had made for the Cells that incloſe them, and drag them out to butcher them, and then throw their little Carcaſſes out of the Hive: a Revolution hard to be underſtood in ſo wiſe a Nation. *If we ſhould add all that is wonderful in this Inſect, it would carry us too far; and how many other Inſects are there whoſe Wonders we don't yet know? and how many more that will for ever be concealed from us?*

FINIS.

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